TECHNICAL REPORT

Sea ice reports for the Antarctic shipping season 2015 - 2016

Prepared by Dr Jan L Lieser, Dr Robert A Massom, Dr Petra Heil

Antarctic Climate & Ecosystems Cooperative Research Centre 2016

ANTARCTIC CLIMATE & ECOSYSTEMS CRC

Sea ice reports for the Antarctic shipping season 2015–2016

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Executive summary:

The sea-ice reports compiled in this document are weekly reports on sea-ice conditions for East Antarctica, including sub-weekly updates. They were prepared to support ship operations in East Antarctica during the 2015/2016 shipping season. These reports were primarily used to inform the Australian Antarctic program, but were partly provided to other Antarctic operators as well. In particular, we assisted the Royal New Zealand Navy (HMNZS *Otago*), the Chinese National Antarctic Research Expeditions (RSV *Xue Long*), the Japan Maritime Self-Defense Force (*Shirase*) and a commercial fishing operator.

Throughout the season, the focus of individual reports shifts with the main purpose of specific voyages of the Australian Antarctic research and supply vessel *Aurora Australis* and other customer requirements. The Antarctic voyages of RSV *Aurora Australis* in the 2015/2016 season were:

No.	Leave port	Main Purpose	Return
V1	28/10/2015	Davis Station resupply	29/11/2015
V2	09/12/2015	Casey Station resupply	07/01/2016
V3	11/01/2016	Marine science; Mawson Station resupply	12/03/2016

The 2015 winter sea-ice season followed on from record-breaking winters of 2012, 2013 and 2014. During the first half of 2015, net Antarctic sea ice was largely above-average conditions and setting new monthly extent records in January, April and May. However, in late July (around mid-winter) the expansion of sea ice slowed markedly and by mid-August the net sea-ice extent dropped to record low daily values, just three months after record daily high values were recorded in May. This change coincided with a large-scale change in atmospheric circulation associated with a developing El Niño in the Pacific Ocean. The annual maximum sea-ice extent was observed in early October, which was only slightly above the long-term average. Spring and summer extent continued at or just above average, until it fell below average in early January 2016. Annual minimum sea-ice extent was recorded in mid-February 2016.

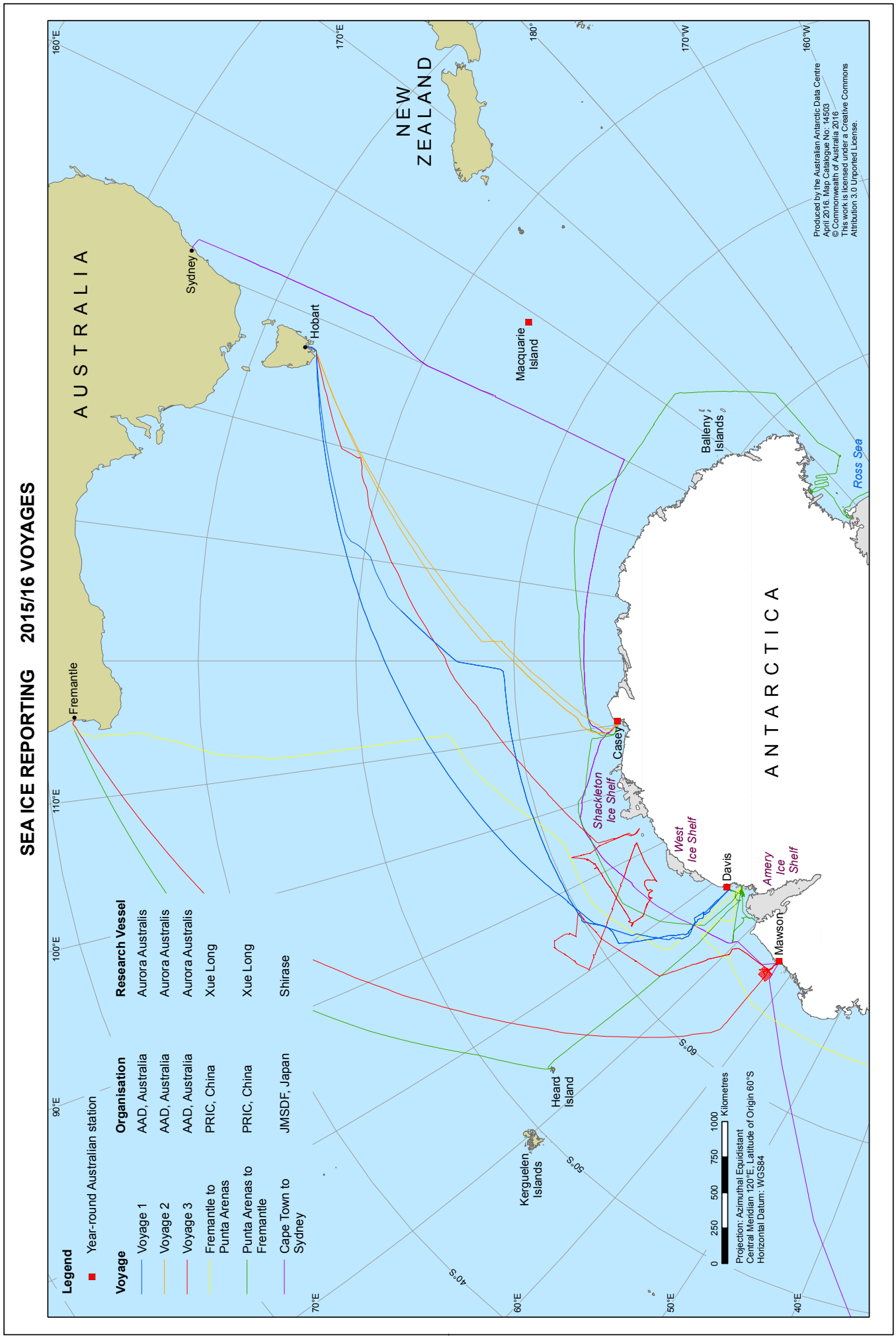
About this report

This compilation report is the fifth volume of sea-ice reports prepared by the Sea Ice Service of the Australian Research Council's Special Research Initiative for Antarctic Gateway Partnership and is supported by the sea-ice group of the Antarctic Climate & Ecosystems Cooperative Research Centre and Australian Antarctic Division. The first report of this compilation was issued in calendar week 20 of 2015, after the 2014/2015 shipping season ended in April 2015.

Previous reports are available from the Manager Communications, Antarctic Climate & Ecosystems Cooperative Research Centre (see inside cover for details).

About the authors

The Sea Ice Service of the Antarctic Gateway Partnership is provided by scientists from a broad spectrum of geophysical disciplines, including remote sensing, meteorology and glaciology. Short biographies of the authors of this report can be found on the inside back cover.


SEA ICE REPORTING 2015/16 VOYAGES
Legend
Year-round Australian station
Voyage
Organisation
Research Vessel
Voyage 1 AAD, Australia Aurora Australis
Voyage 2 AAD, Australia Aurora Australis
Voyage 3 AAD, Australia Aurora Australis
Fremantle to Punta Arenas PRIC, China Xue Long
Punta Arenas to Fremantle PRIC, China Xue Long
Cape Town to Sydney JMSDF, Japan Shirase
AUSTRALIA
NEW ZEALAND
ANTARCTICA
Sydney
Hobart
Fremantle
Macquarie Island
Balleny Islands
Ross Sea
Casey
Davis
Mawson
Shackleton Ice Shelf
West Ice Shelf
Amery Ice Shelf
Heard Island
Kerguelen Islands
160°E
170°E
180°
170°W
160°W
110°E
100°E
90°E
70°E
60°E
50°E
40°E
60°S
50°S
40°S
0 250 500 750 1000 Kilometres
Projection: Azimuthal Equidistant
Central Meridian 120°E, Latitude of Origin 60°S
Horizontal Datum: WGS84
Produced by the Australian Antarctic Data Centre
April 2016. Map Catalogue No: 14503
© Commonwealth of Australia 2016
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Contents

Frequently used acronyms

AAD	Australian Antarctic Division
ACE CRC	Antarctic Climate & Ecosystems Cooperative Research Centre (AUS)
AMSR-2 [1]	Advanced Microwave Scanning Radiometer 2
ASI	ARTIST [2] Sea Ice algorithm
AVHRR	Advanced Very High Resolution Radiometer
BNSK	Call sign: Research/Survey Vessel *Xue Long*
BoM	Bureau of Meteorology (AUS)
ESA	European Space Agency
FHZI	Call sign: Anchor Handling Vessel *l'Astrolabe*
GMRT	Global Multi-Resolution Topography
IBCSO	International Bathymetric Chart of the Southern Ocean
ICDC	Integrated Climate Data Centre, University of Hamburg
IR	Infrared spectrum
JAXA	Japan Aerospace Exploration Agency
JSNJ	Call sign: Icebreaker *Shirase*
MODIS [3]	Moderate Resolution Imaging Spectroradiometer
NASA	National Aeronautics and Space Administration (USA)
NSIDC	National Snow and Ice Data Center (USA)
OLI	Operational Land Imager (scientific payload on Landsat-8 satellite)
SAR	Synthetic Aperture RADAR
Suomi NPP	Suomi National Polar-orbiting Partnership
TIR	Thermal Infrared spectrum
USGS	United States Geological Survey (USA)
VIIRS	Visible Infrared Imaging Radionmeter Suite

[1] The AMSR-2 instrument is onboard the GCOM-W1 satellite, which is operated by JAXA.
[2] Arctic Radiation and Turbulence Interaction STudy (ARTIST)
[3] The MODIS instrument is operational on two satellites: AQUA and TERRA, both operated by NASA.

Sea Ice Report #20.1/2015

by the AAD/ACE CRC Sea Ice Group*

15/05/2015

This report examines Southern Hemisphere sea-ice conditions.

The autumn season of 2015 is exhibiting a record-breaking trend again, with more than 20 days showing new record daily sea-ice extent for Antarctica as a whole, since the onset of the freezing season in February. Today in East Antarctica, the sea-ice extent is already close to the long-term median extent for May (the red line in Figure 1), and it is expected that sea ice will grow beyond this line (northward) steadily throughout the rest of the month.

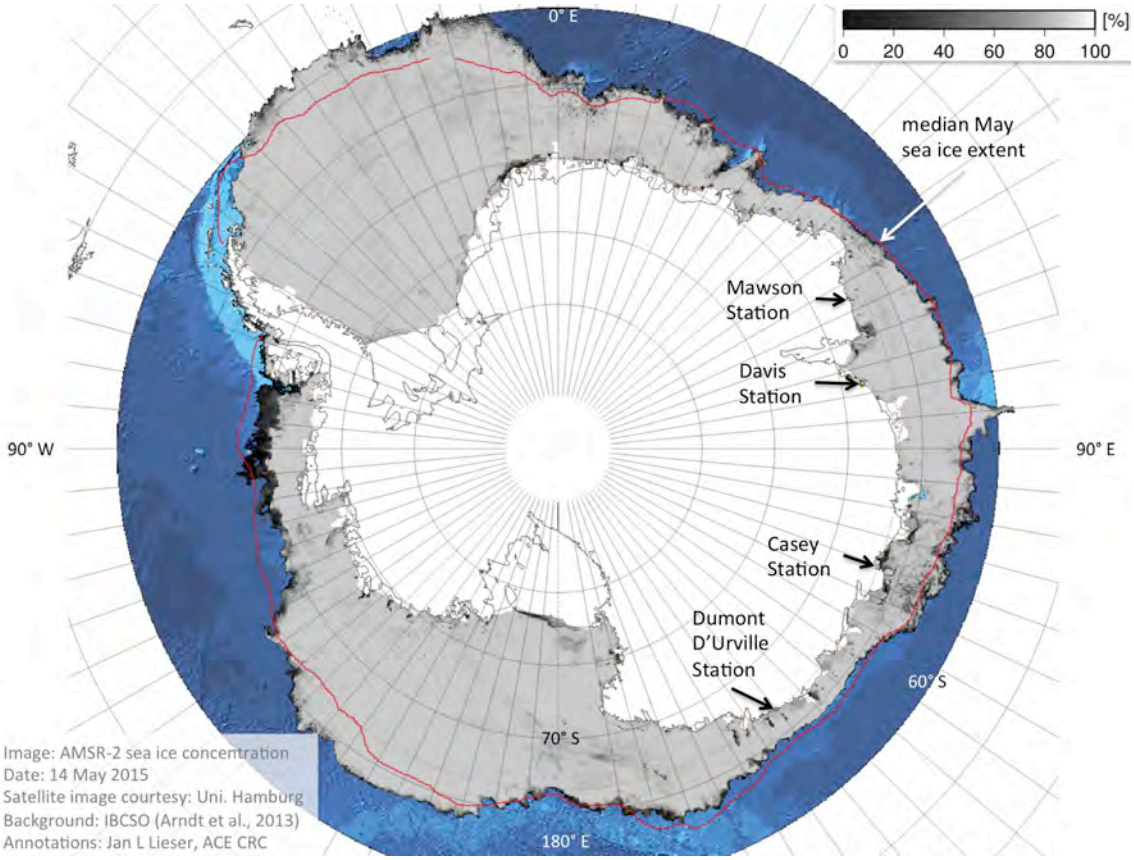

Figure 1: AMSR-2 sea-ice concentration, acquired 14/05/2015 and provided by Universität Hamburg.

In April 2015, we observed above average sea-ice concentration almost everywhere in Antarctica, with only isolated regions of below average sea-ice concentration in the Amundsen Sea (between 110° W and 125° W), and to a lesser degree in the Bellingshausen Sea (between 85° W and 90° W)

*Disclaimer: *Every effort is made to ensure the data provided in this report are accurate at the date of publication; however the report is provided without warranty of any kind. The figures and charts provided in this report are intended only as a guide to ice conditions and are not suitable for navigation.*

and off George V Land (between 150° E and 160° E) (see Figure 2). All other regions showed anomalously high sea-ice concentration up to and including 100% above the long-term average, particularly in the Weddell Sea and in East Antarctica between 90° E and 100° E. The black line in Figure 2 denotes the long-term average sea-ice extent for April.

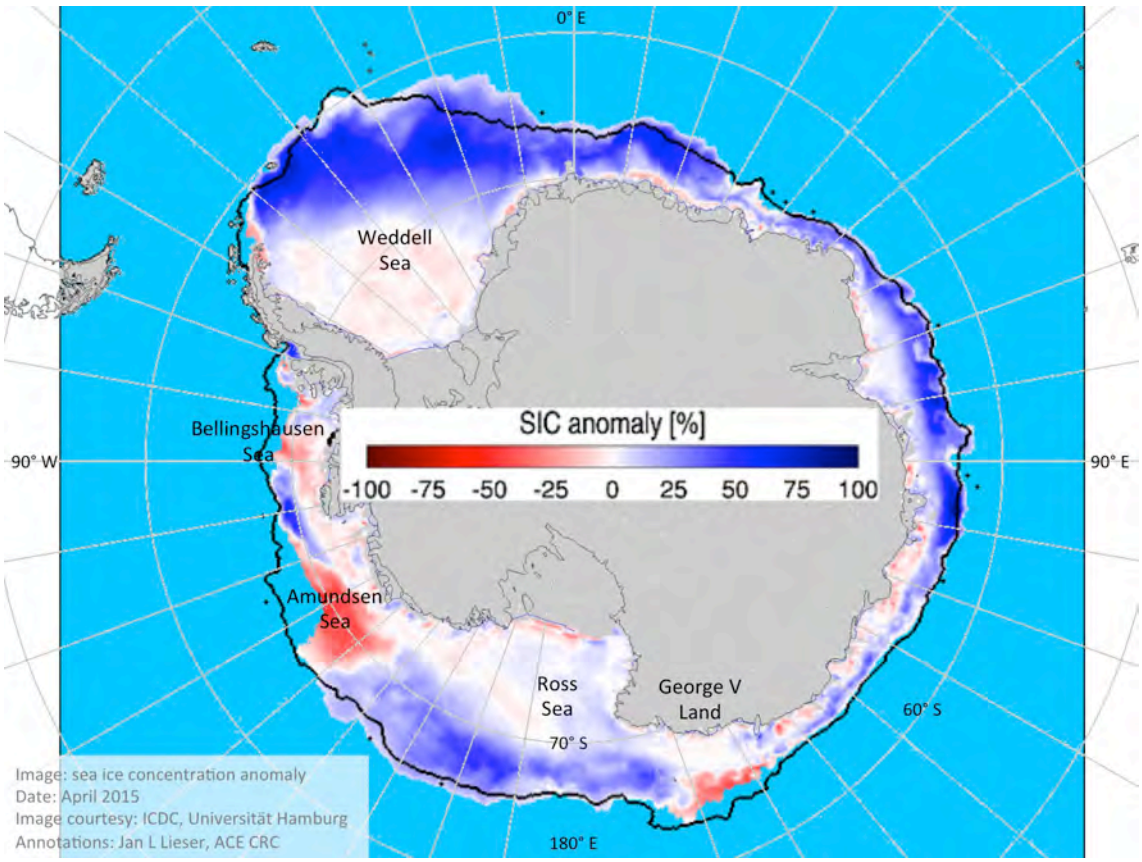

Figure 2: Sea-ice concentration anomaly for April 2015. Image courtesy Integrated Climate Data Centre (ICDC), Universität Hamburg.

With best regards,

Jan.

Sea Ice Report #33.1/2015

by the AAD/ACE CRC Sea Ice Group*

14/08/2015

This report examines East Antarctic sea-ice conditions.

- **Australian Bases**
  Figure 1 shows sea-ice concentration in the region of Australian Antarctic bases in East Antarctica and the locations of major tabular icebergs.

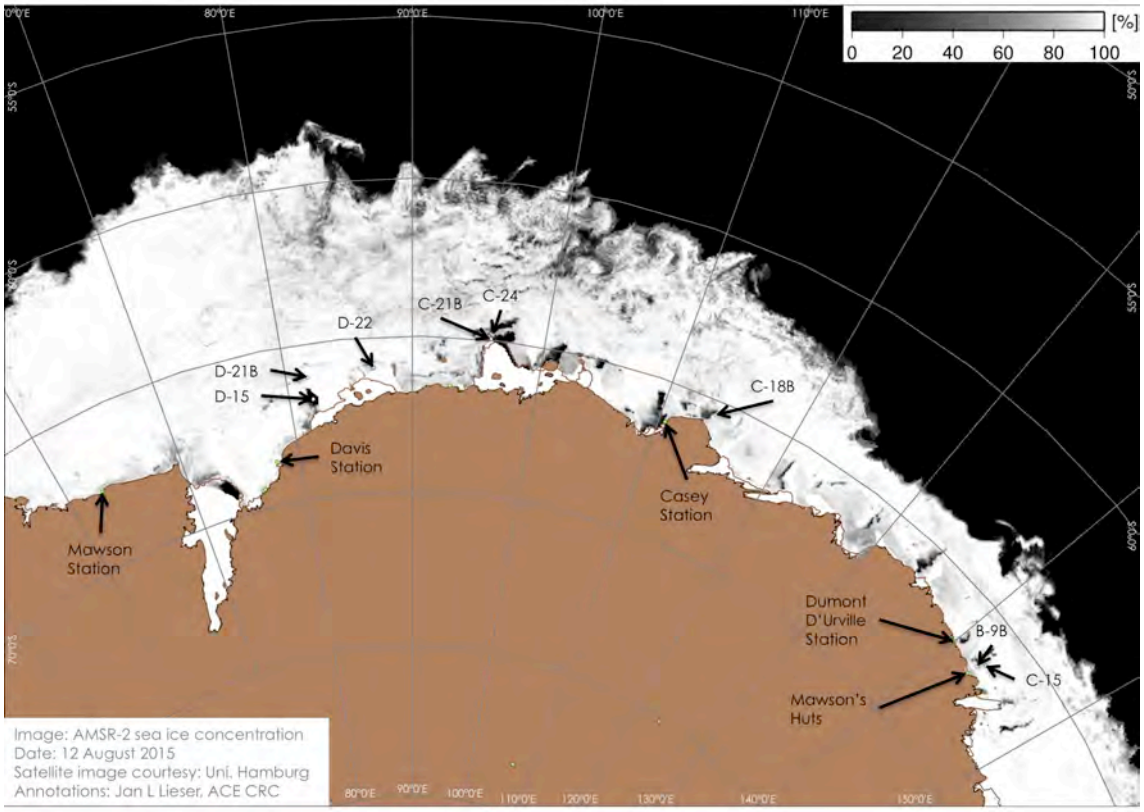

Figure 1: AMSR-2 sea-ice concentration, acquired 12/08/2015 and provided by Universität Hamburg.

Sea-ice extent had an unusual development during the past few months, since the onset of the winter season. The beginning of winter was largely characterised by above average sea-ice extent – including daily records for most days in May, around all of Antarctica. In July however, the rate of increase in extent of sea ice, which could typically be expected during this time of year, has

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slowed markedly and the overall (circum-Antarctic) sea-ice extent has dropped below the long-term (1981-2010) average, as of 12/08/2015. What this development entails for other geophysical sea-ice parameters, such as thickness or roughness, is uncertain at this stage.

- **Davis Station region**
  Figure 2 shows a high-resolution SAR scene of iceberg D-15 at the West Ice Shelf, north of Davis Station. During June and July, a major rift appeared across the southwestern part of the berg and about one-fifth of the berg (roughly the size of King Island) is about to break away.

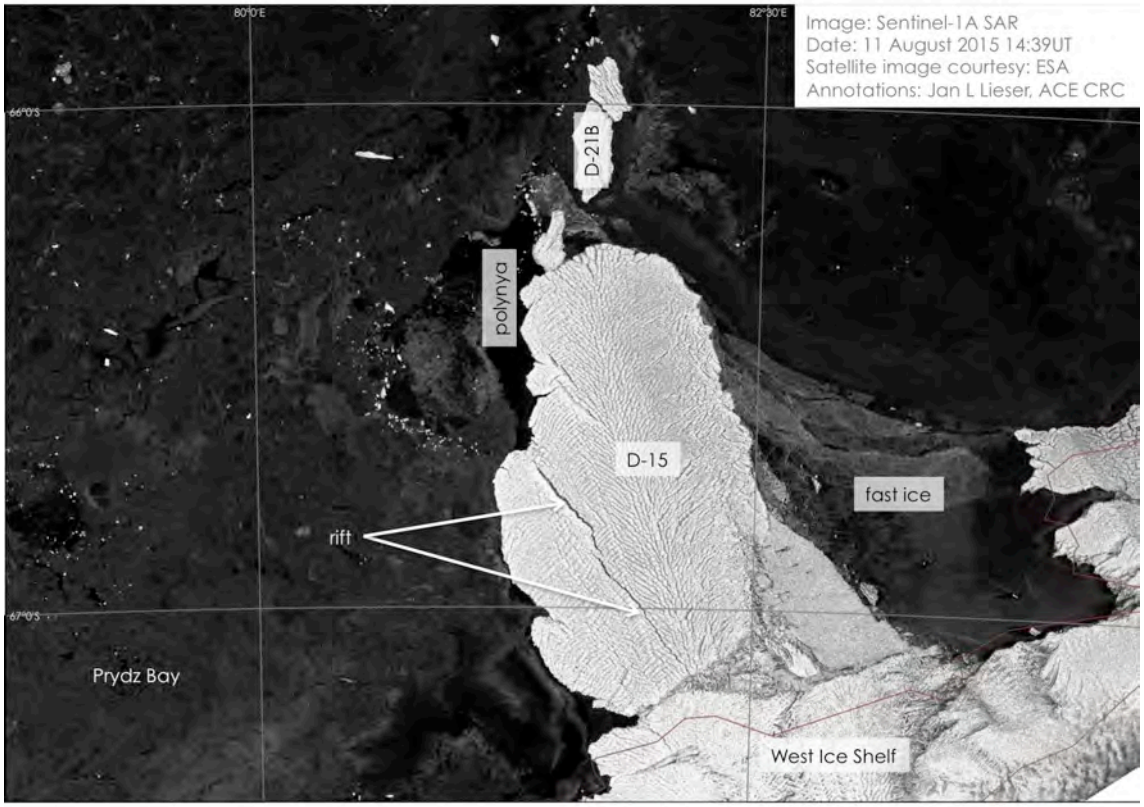

Figure 2: Sentinel-1a SAR scene, acquired 11/08/2015 and provided by ESA.

- **Commonwealth Bay**
  Figure 3 shows a thermal infrared scene of Commonwealth Bay and the group of large icebergs north of it. The polynyas off Dumont D'Urville Station, Mawson's Huts and the Mertz Glacier are visible as dark patches near the coastal cloud-free part of the image.

  The red line in the image follows a warmer region (darker structure), most likely caused by thinner sea ice or even open water. This indicates that the fast ice surrounding the group of icebergs is more dynamic, compared to previous years (after the grounding of B-9B in the area).

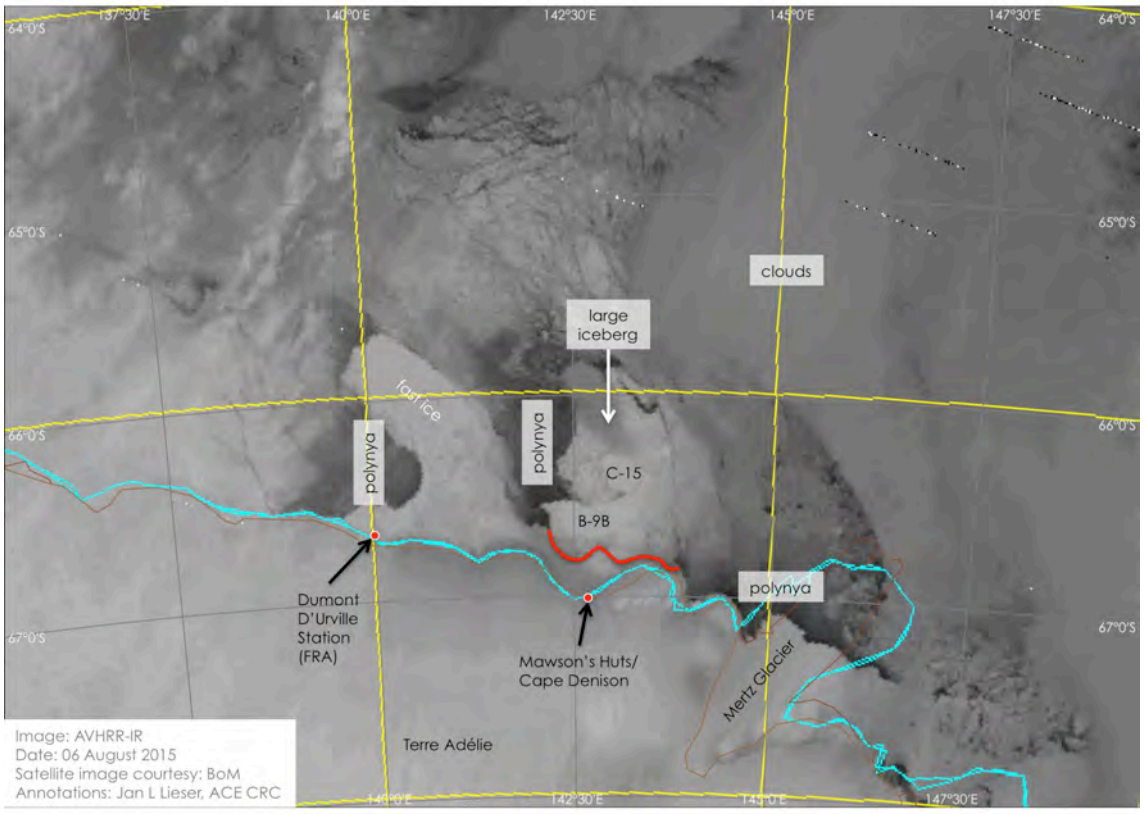

Figure 3: AVHRR infrared scene, acquired 06/08/2015 and provided by Bureau of Meteorology.

With best regards,

Jan.

Sea Ice Report #36.1/2015

by the AAD/ACE CRC Sea Ice Group*

04/09/2015

This report examines sea-ice conditions of eastern Prydz Bay and Commonwealth Bay.

- **Davis Station**
  Figure 1 shows a high-resolution SAR scene of the region between iceberg D-15, off the West Ice Shelf, and Davis Station. The rift across the southwestern part of D-15 has not widened significantly since the previous reporting (Sea Ice Report #33.1/2015)

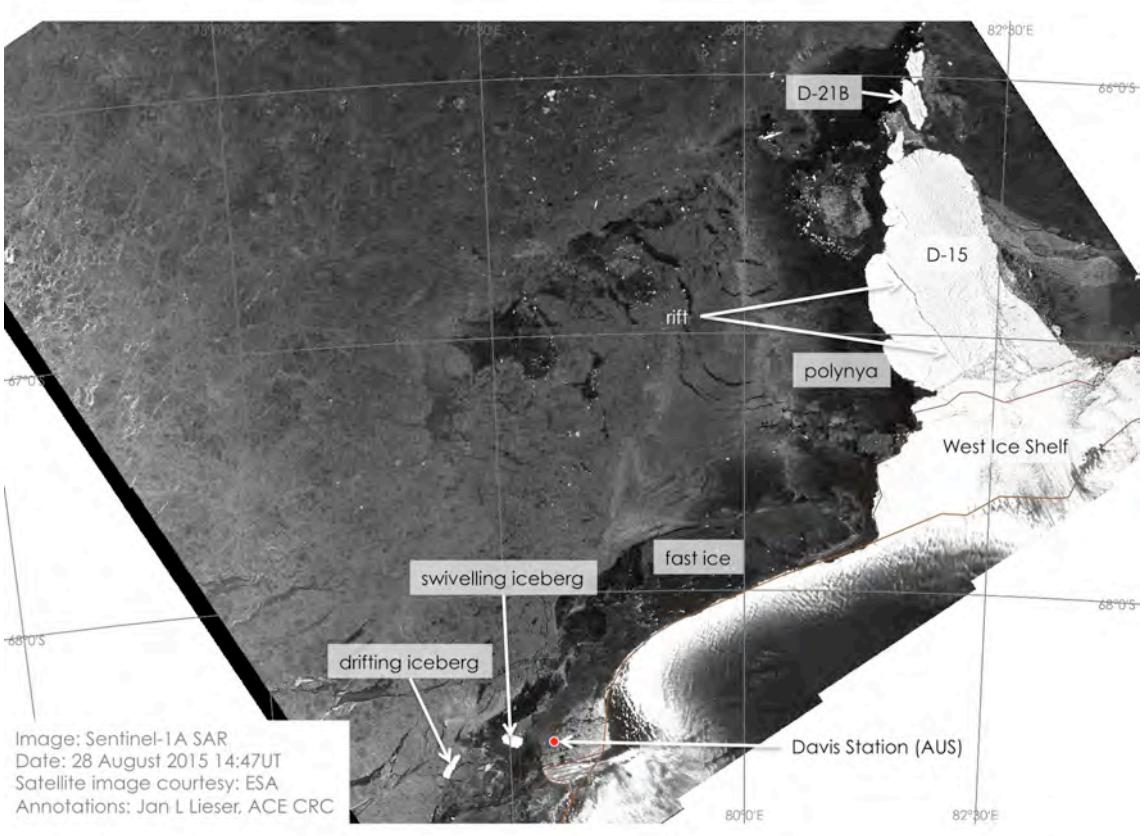

Figure 1: Sentinel-1a SAR scene, acquired 28/08/2015 and provided by ESA.

Two larger icebergs can be identified off Davis Station. The one closer to the station (~4.5 nautical miles long) is currently swivelling around its western end, the second one to the southwest (~6 nautical miles long) appears to be drifting more freely in a southwesterly direction.

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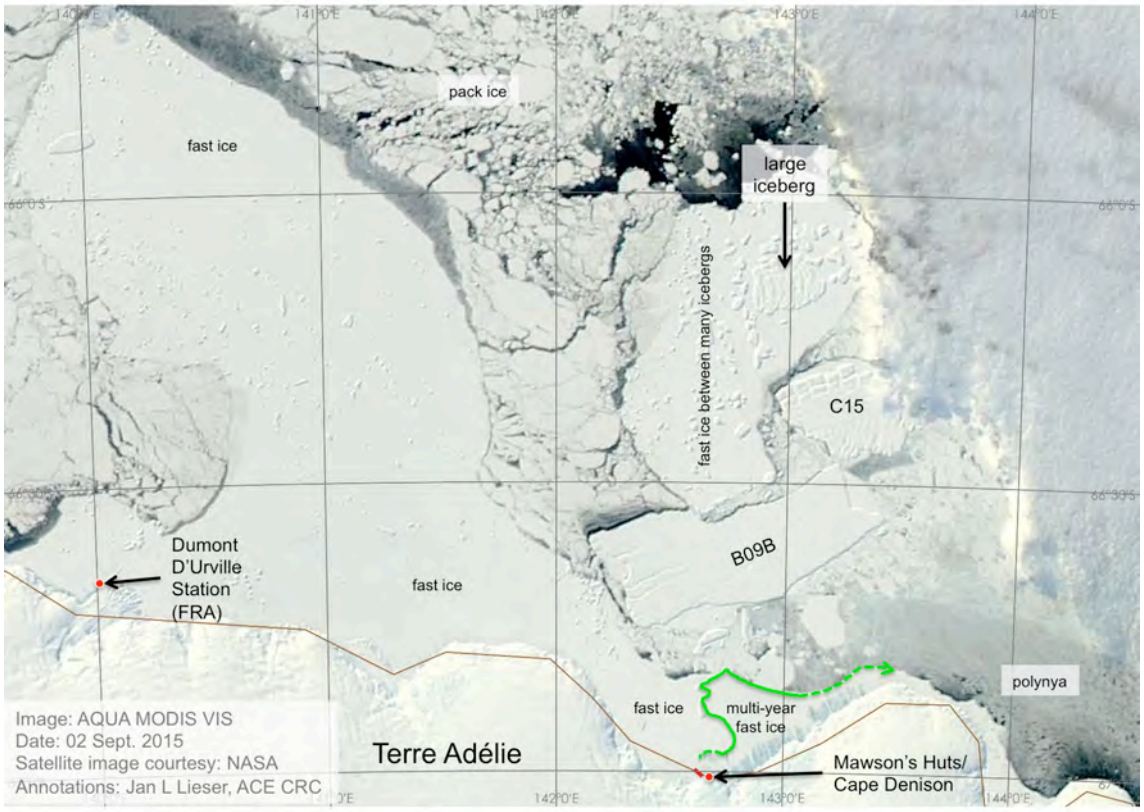

Figure 2: MODIS VIS scene, acquired 02/09/2015 and provided by NASA.

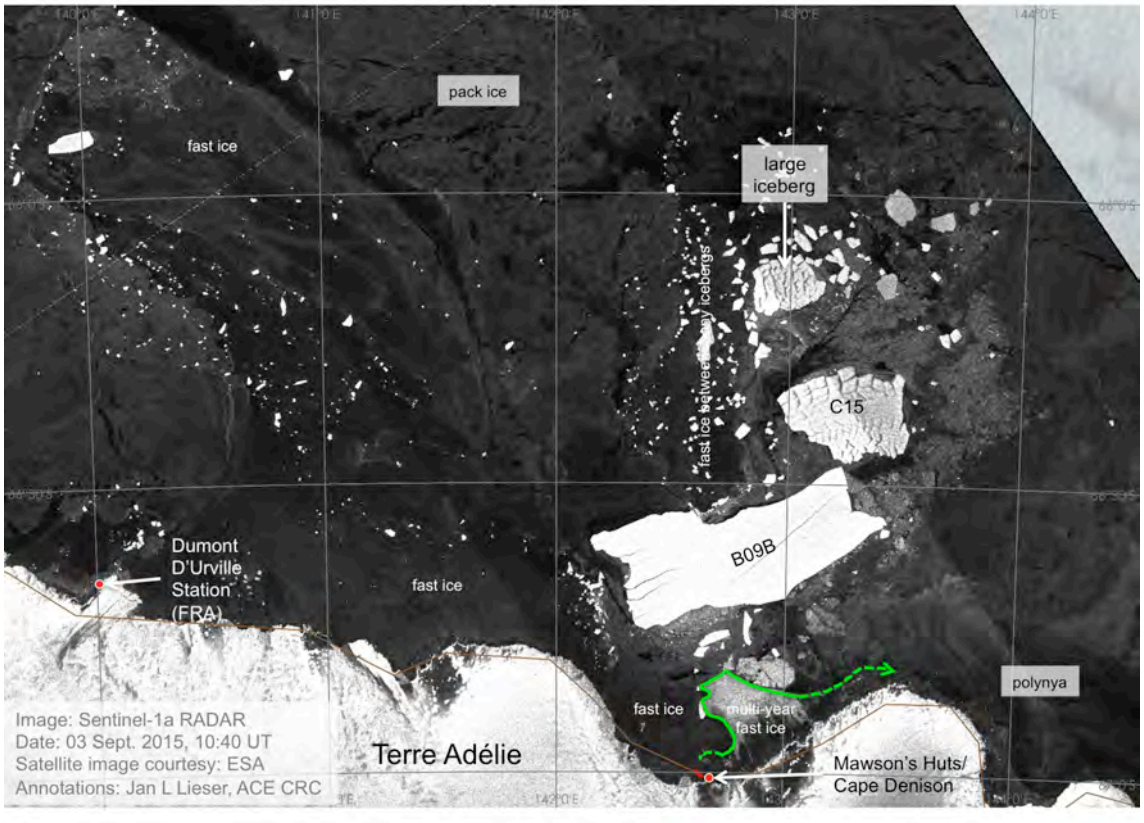

Figure 3: Sentinel-1a SAR scene, acquired 03/09/2015 and provided by ESA.

- **Commonwealth Bay**
  Figures 2 and 3 display the same geographical frame off Adélie Land, between Dumont D'Urville Station and Mawson's Huts, in Commonwealth Bay. In the eastern part of the bay, the green scribble line marks the outer edge of multi-year fast ice that has been in-situ for more than one summer season. The precise western and eastern extent is uncertain and marked with a dashed green line. The short red line indicates the site of a proposed landing strip, west of Mawson's Huts.

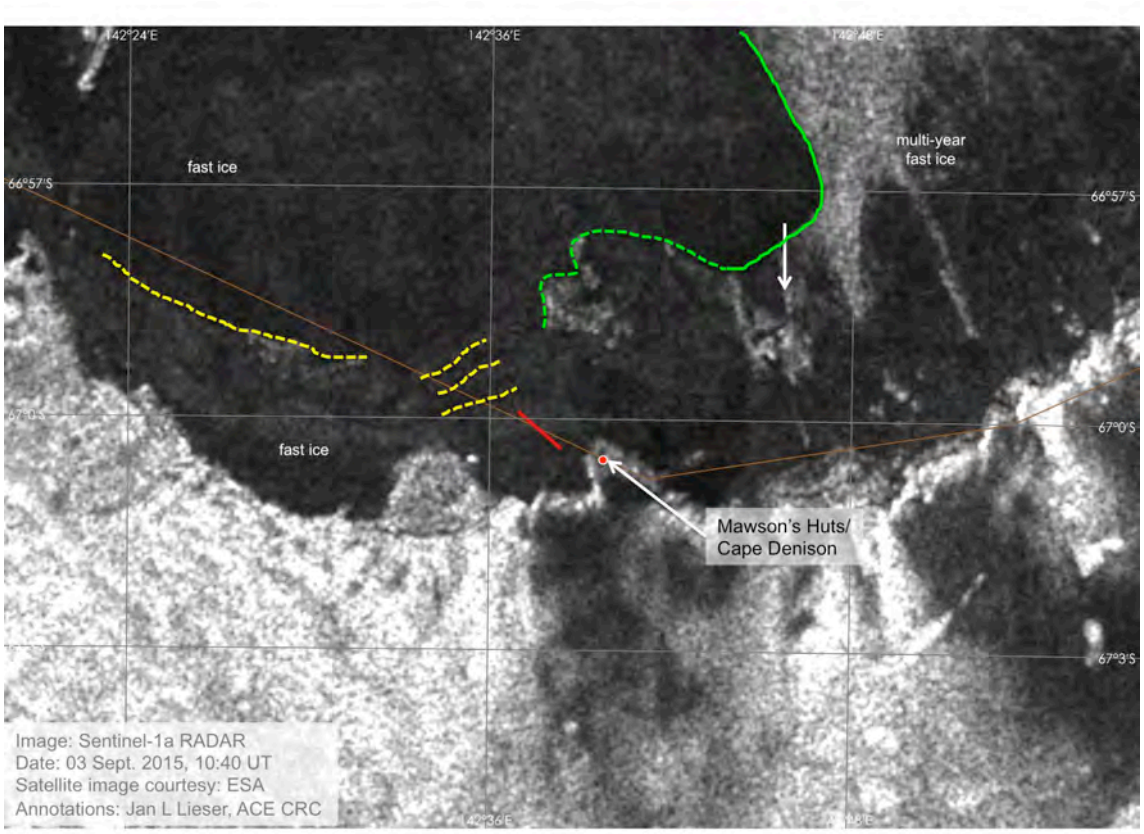

Figure 4: Close-up view of Figure 3 showing the southern part of Commonwealth Bay and Mawson's Huts.

Figure 4 shows a close-up view of the southern part of Commonwealth Bay, with the green (dashed) and red line as in Figures 2 and 3. Additionally, a few linear kinematic features are annotated with yellow dashed lines, indicating transitions within the near-shore fast ice, possibly caused by previous smaller fast ice outbreaks during the initial re-freezing period, following the larger fast ice outbreak, as reported in Sea Ice Report #11.2/2015.

With best regards,

Jan.

Sea Ice Report #39.1/2015

by the AAD/ACE CRC Sea Ice Group*

23/09/2015

Throughout August 2015, the circum-Antarctic sea-ice extent was slightly below the 30-year (1981-2010) average, and this August was the first month since November 2011 of below average sea-ice extent.

- **Australian Bases**
  Figure 1 shows a sea-ice concentration map for East Antarctica with respect to the September median sea-ice extent (dark blue line). It is obvious that the current extent of sea ice is generally below (south of) the long-term median.

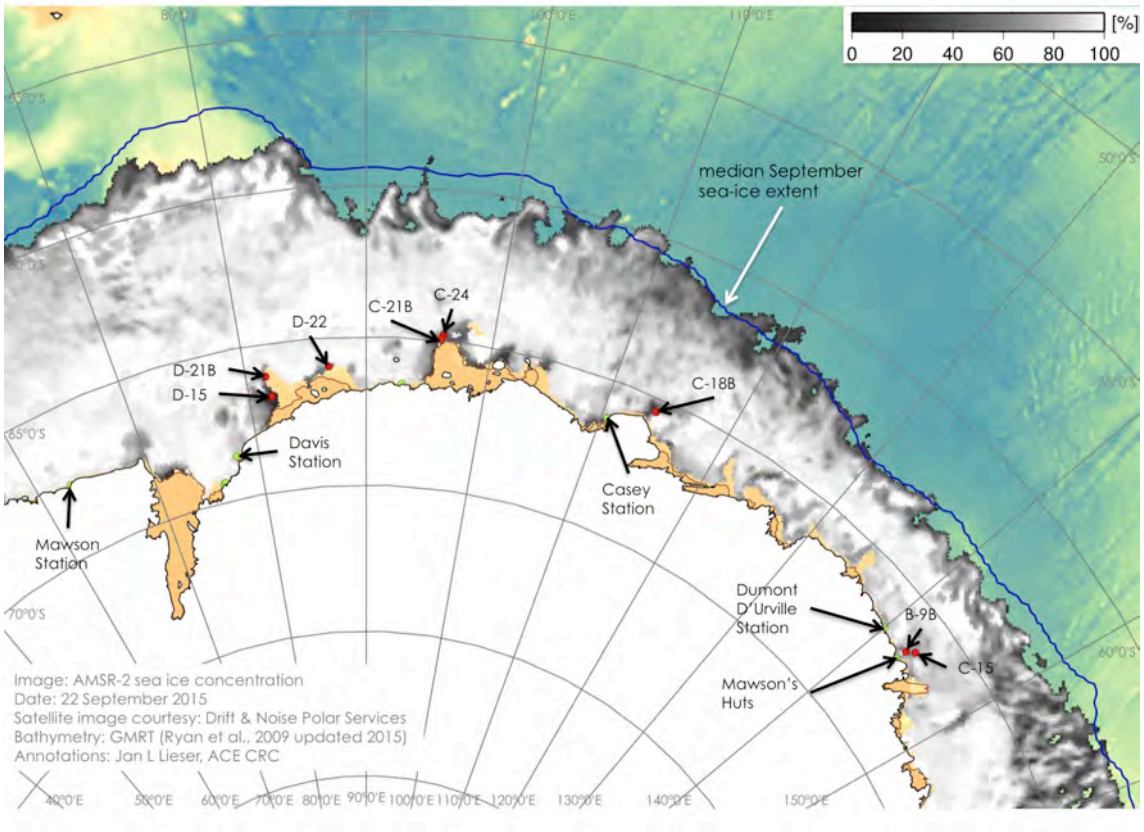

Figure 1: Sea-ice concentration, acquired 22/09/2015 and provided by Drift & Noise Polar Services.

The northern sea-ice edge exhibits many strips and patches and undulations, in the sector shown in Figure 1.

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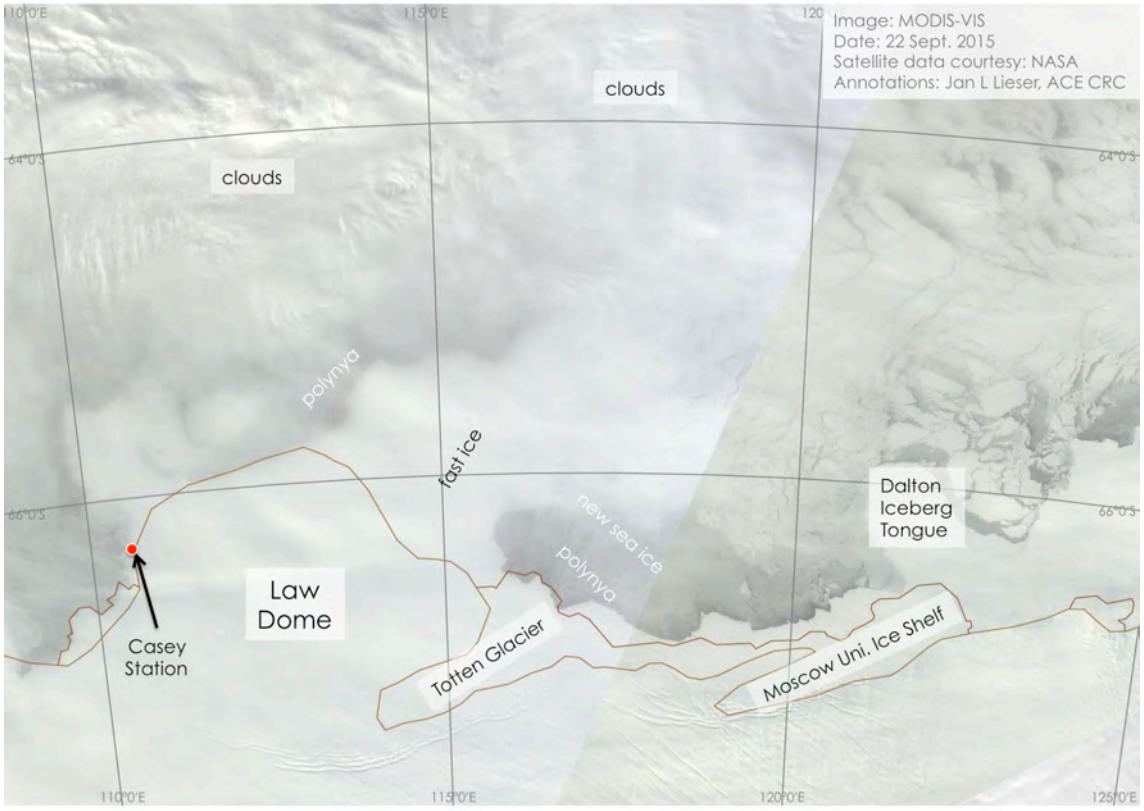

Figure 2: MODIS VIS scene, acquired 22/09/2015 and provided by NASA.

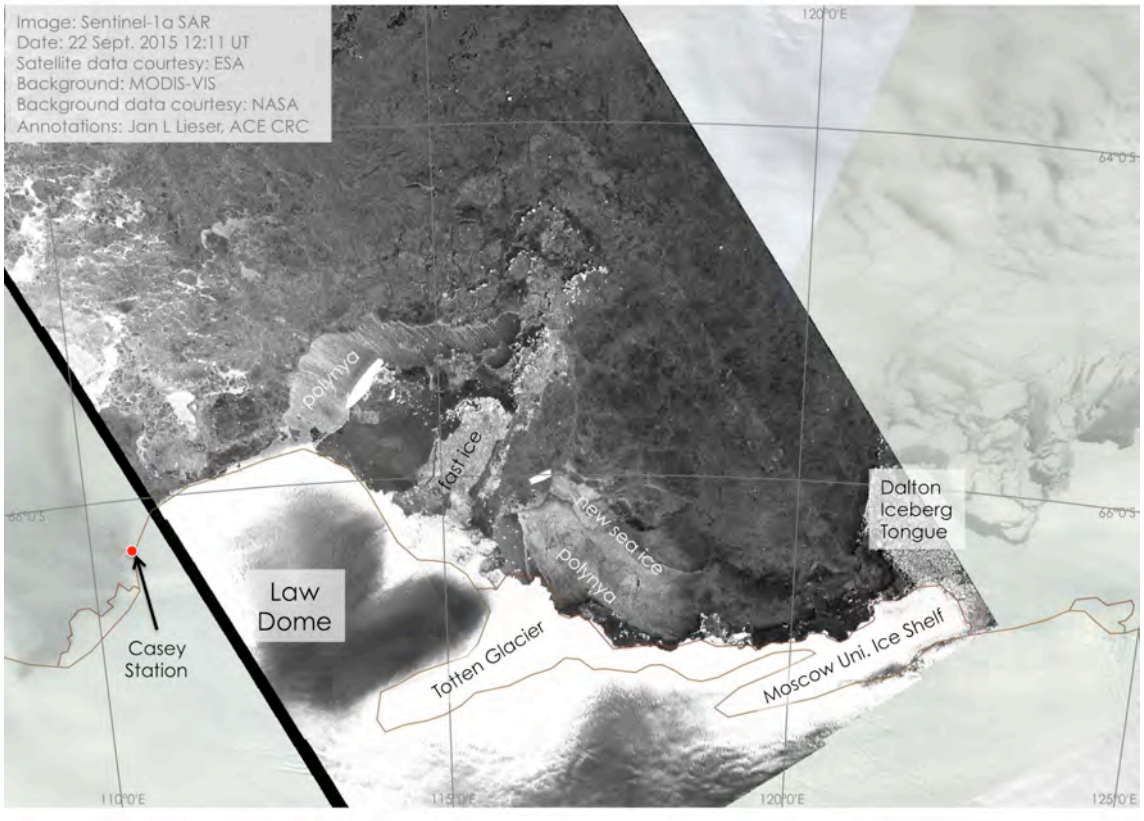

Figure 3: Sentinel-1a SAR scene, acquired 22/09/2015 and provided by ESA.

- **Totten Glacier**
  The same geographical frame off the Totten Glacier is shown in Figures 2 and 3, as seen by the MODIS instrument and Sentinel-1a's SAR, respectively. After the passing of a large low pressure system, a large polynya has formed in front of the Totten Glacier, spanning more than 30 nautical miles between the glacier and the southern pack ice edge where new sea ice accumulates. Sea ice north of the Dalton Iceberg Tongue can also be seen drifting as very large floes in northeasterly direction.

- **Commonwealth Bay**
  While Commonwealth Bay (Mawson's Huts/Cape Denison) remains covered by fast ice, the sea-ice region north of it – surrounding the iceberg-troika of B-9B, C-15 and the large berg north of it – is still quite dynamic. Especially iceberg C-15 appears to be not rigidly grounded and is rotating in the area north of B-9B (see Figure 4).

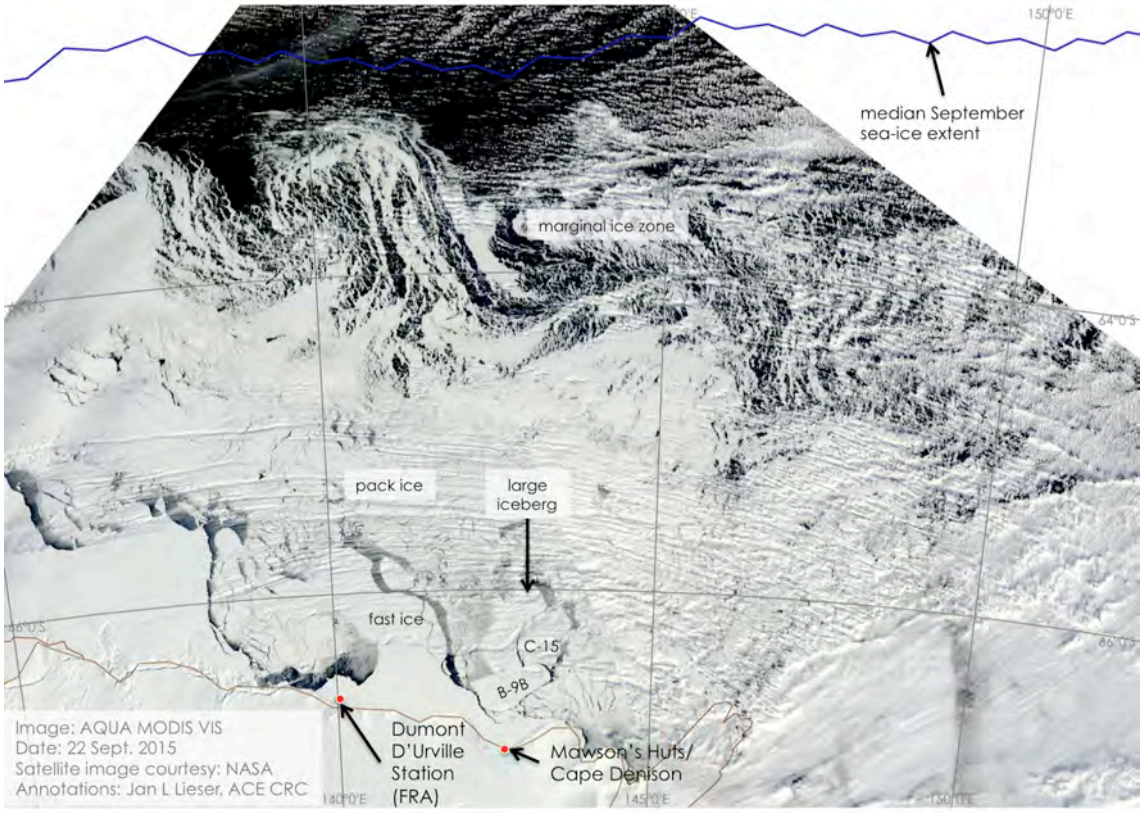

Figure 4: MODIS VIS scene, acquired 22/09/2015 and provided by NASA.

It is also evident from Figure 4 that the sea-ice edge is well below (south of) the long-term median sea-ice extent (dark blue line) and the marginal ice zone shows many strips and patches, and large undulations (as mentioned above).

With best regards,

Jan.

Sea Ice Report #40.1/2015

by the AAD/ACE CRC Sea Ice Group*

29/09/2015

This report takes a closer look at sea-ice conditions in Commonwealth Bay.

- **Commonwealth Bay**
  Figures 1 to 4 show the same geographical frame between Dumont D'Urville Station and the Mertz Glacier, as seen by a variety of sensors, all within 48 hours.

  The MODIS image (Figure 1) is affected by clouds only in the northwestern part of the image. Two consecutive images of the region taken by the MODIS instruments on both, the Terra and Aqua satellites, only hours apart on 27/09/15, reveal a considerable movement of iceberg B-9B of approximately 2 km in an eastward direction, as well as some rotational movement of iceberg C-15. As mentioned in previous reports, the region is still quite dynamic, at the height of the winter season.

  The multi-year fast ice inside Commonwealth Bay (covering the eastern half) can be identified in the SAR scene (Figure 2) as a whiter patch (higher roughness). The western half of the bay is occupied by fast ice that has formed earlier this autumn.

  A very high resolution (30 m) Landsat-8 visible scene is shown in Figure 3, overlain on the SAR scene of Figure 2. It reveals more detail of the fast ice between Dumont D'Urville Station and Cape Denison. Clouds are visible with red-ish/pink colouring in the image. The corresponding thermal-infrared scene (Figure 4) reveals with similar detail the relative surface temperature of the region, with cold showing as dark grey (for example the surface of icebergs) and warm as whiter shades (for example in the polynya off the French station).

  In the hours between the Sentinel-1a SAR and the Landsat-8 acquisitions, iceberg B-9B has shifted southward by about 1 km, as indicated by the little yellow arrow in Figures 5 and 6. The entire region between the berg in the north and the fast ice in the south has been compressed, which is also evident from the shifted locations of the iceberg fragments (annotated in the figures) and the overall appearance of the sea ice.

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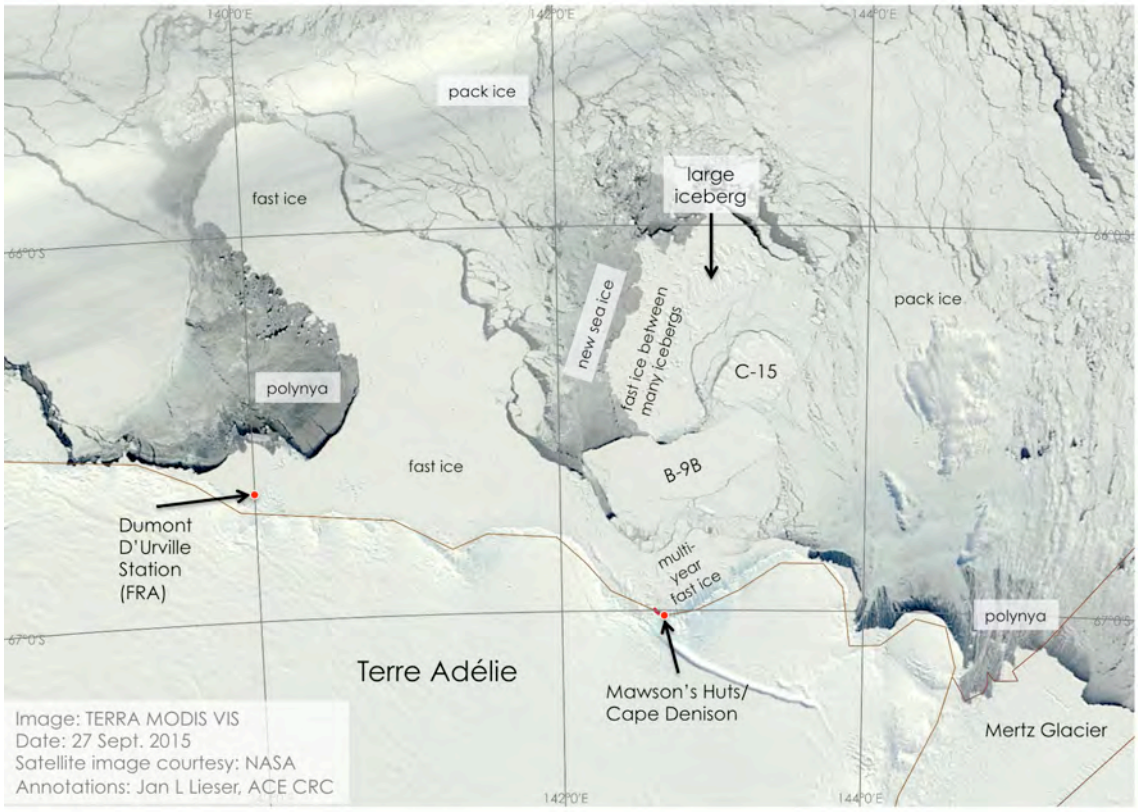

Figure 1: MODIS VIS scene, acquired 27/09/2015 and provided by NASA.

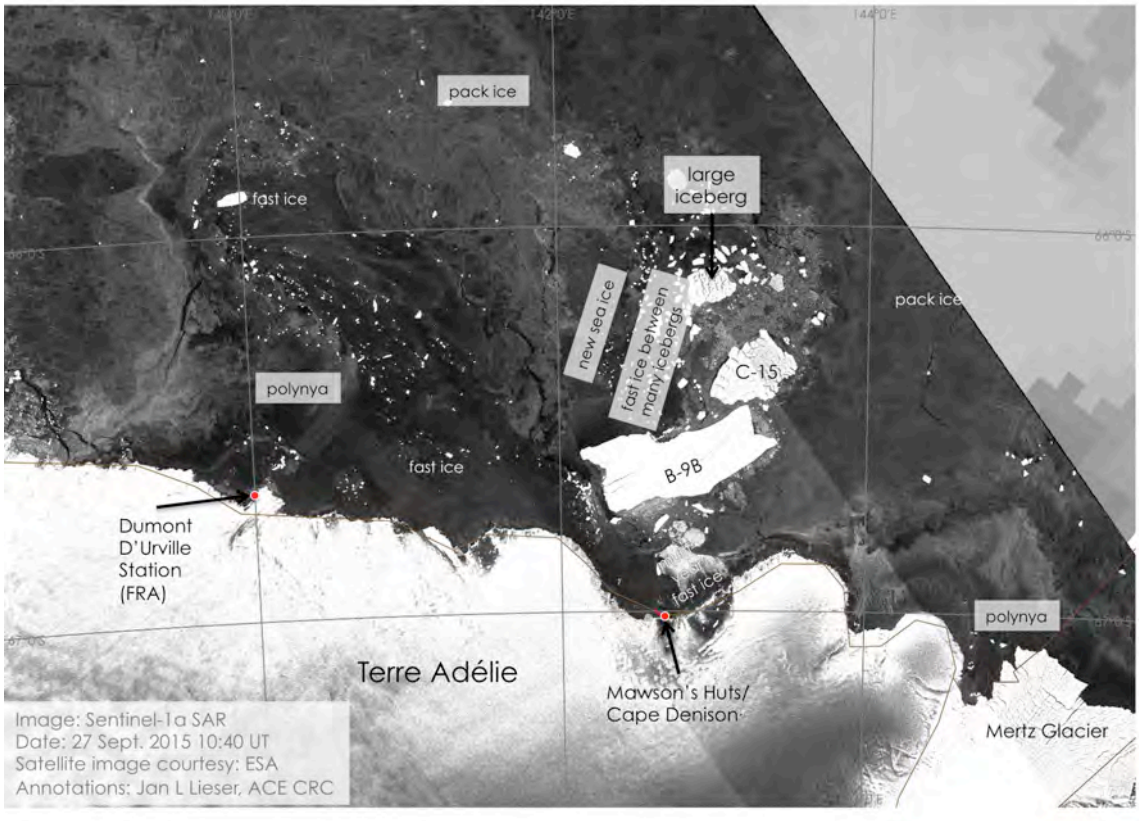

Figure 2: Sentinel-1a SAR scene, acquired 27/09/2015 and provided by ESA.

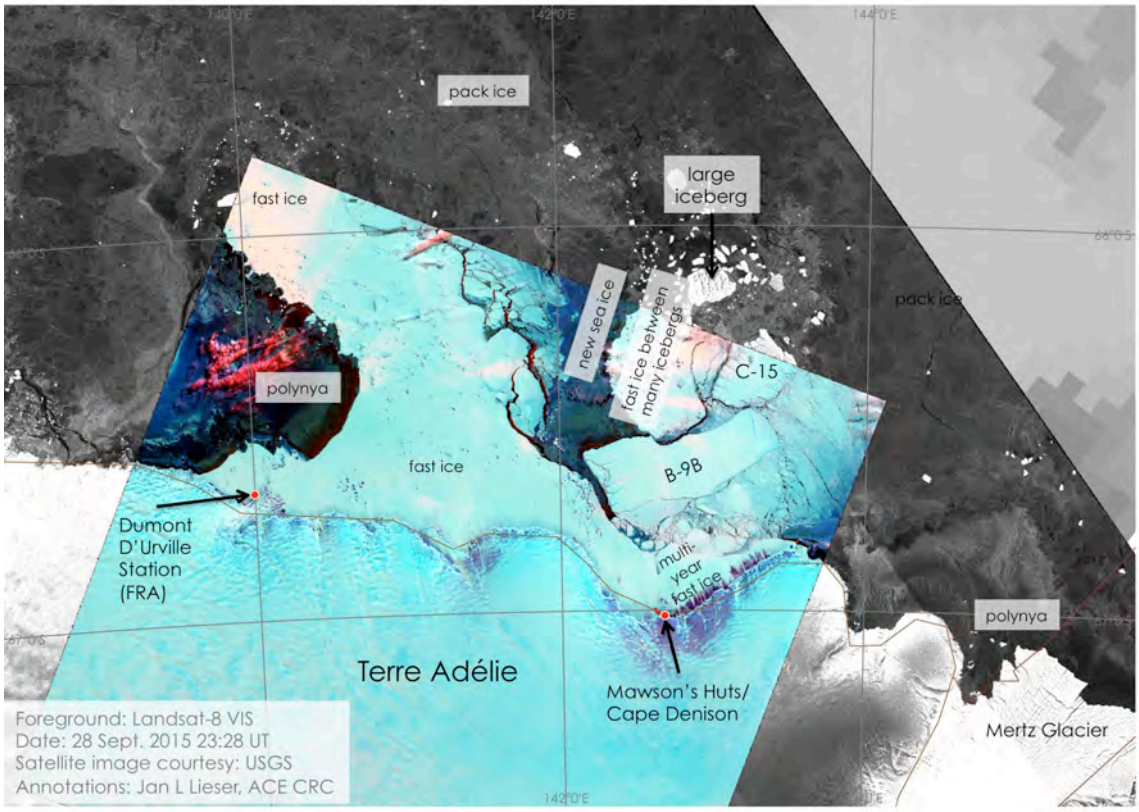

Figure 3: Landsat-8 VIS scene, acquired 28/09/2015 and provided by USGS.

Figure 4: Landsat-8 TIR scene, acquired 28/09/2015 and provided by USGS.

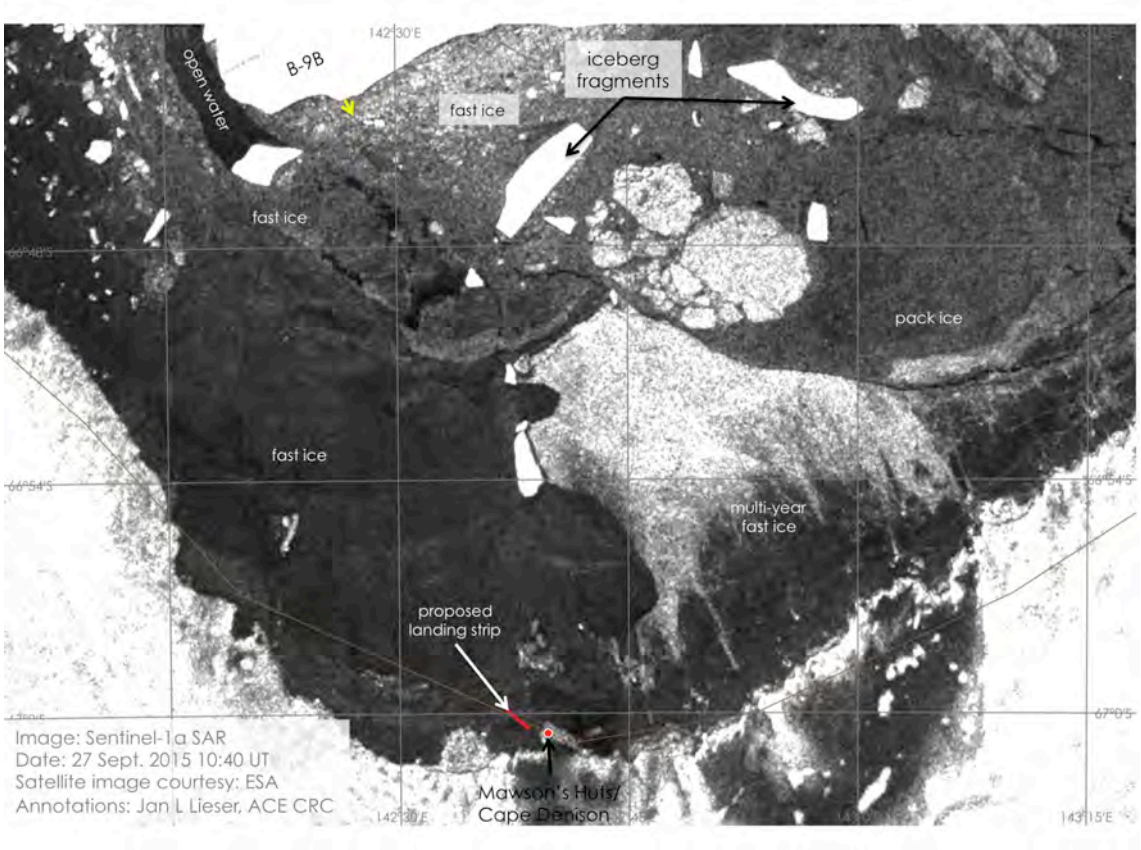

Figure 5: Sentinel-1a SAR scene, acquired 27/09/2015 and provided by NASA.

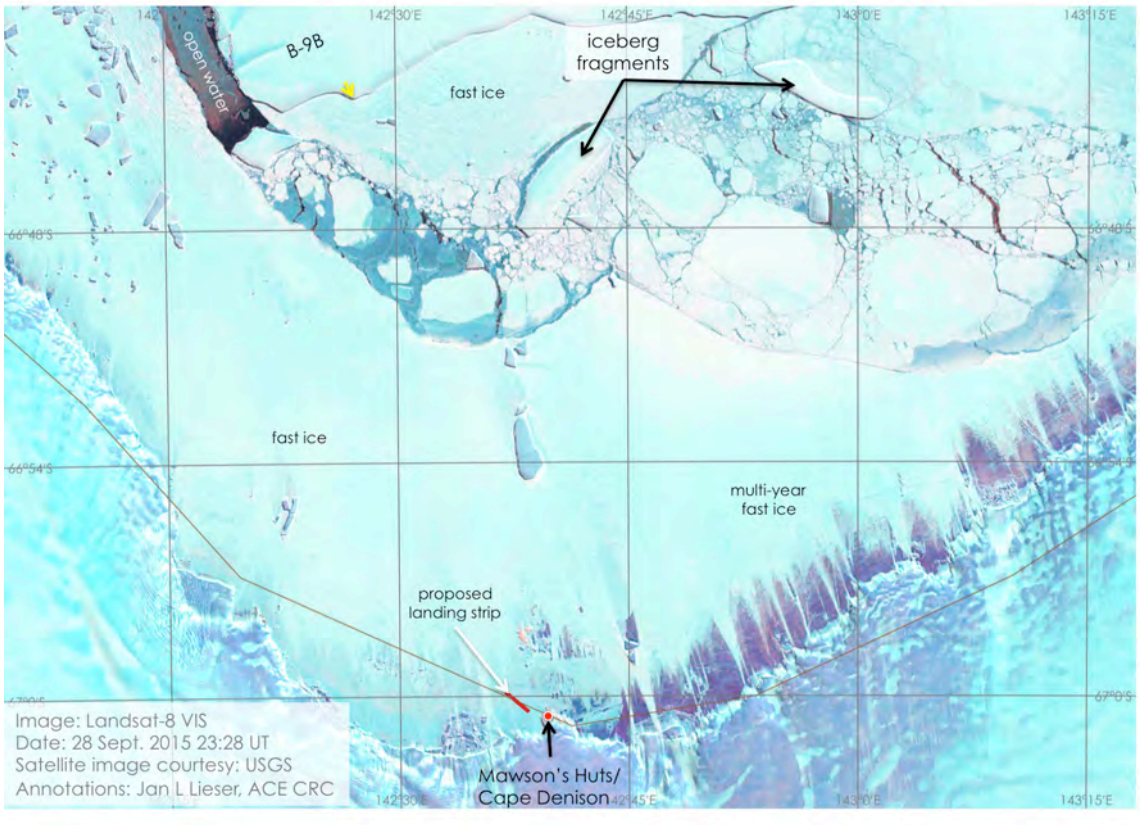

Figure 6: Landsat-8 VIS scene, acquired 28/09/2015 and provided by USGS.

In all images of this report, a little red line indicates the location of a proposed landing strip near Mawson's Huts, at Cape Denison. It is depicted clearer in Figures 5 and 6, where the fast ice conditions can be examined in more detail from close-up maps of the region. The strip lies on the NaturalEarth grounding line (shown in brown), which might not be correct in this part of the world due to its coarse resolution.

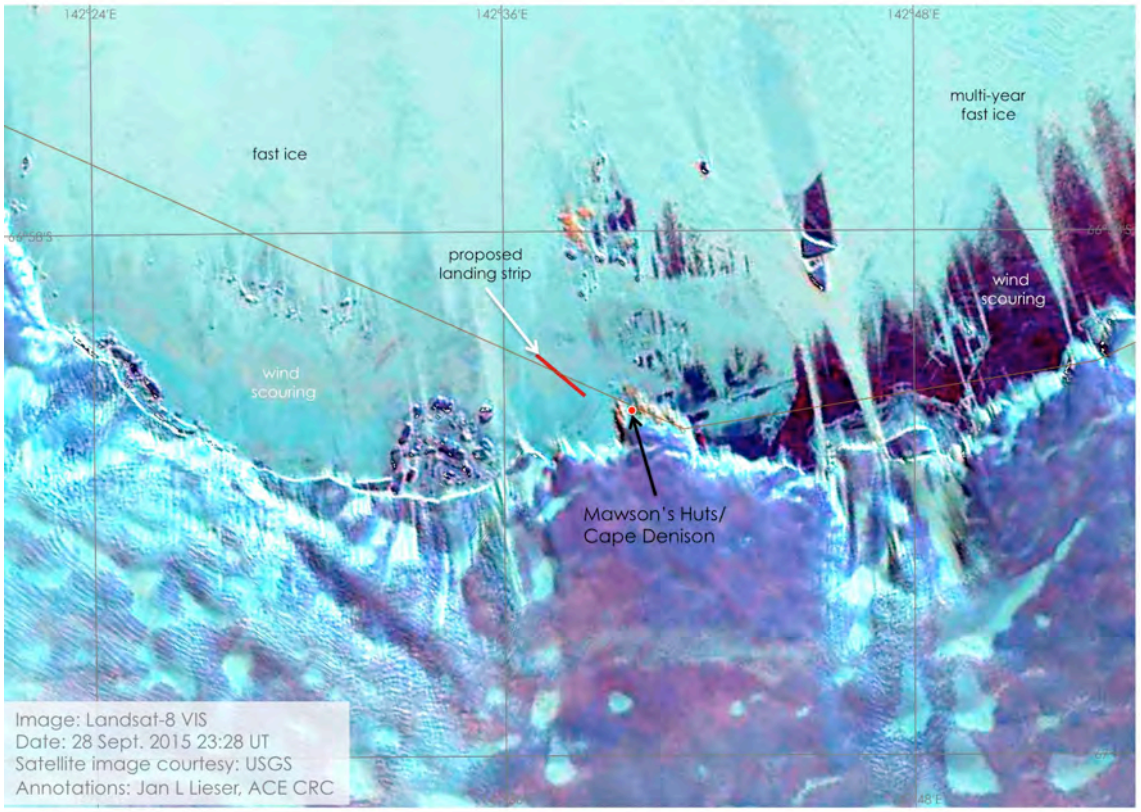

Figure 7: Landsat-8 VIS scene, acquired 28/09/2015 and provided by USGS.

Off Cape Denison, the offshore fast ice is shown in Figure 7. The exact boundary between the multi-year fast ice in the east and the first year fast ice in the west can not be determined from the imagery. The proposed landing strip is located close to the shore in a region that is subject to wind scouring of the snow and sea-ice surface. The corresponding SAR scene (see Figure 5) shows a slight banding pattern at an angle relative to the direction of the landing strip, which can indicate an underlying roughness pattern.

With best regards,

Jan.

Sea Ice Report #40.2/2015

by the AAD/ACE CRC Sea Ice Group*

01/10/2015

This report takes a closer look at sea-ice conditions off Davis Station.

- **Davis Station**
  Currently, the sea-ice edge is approximately 630 nautical miles north of Davis Station. This is roughly 50 nautical miles less than the long-term median extent for September and for October, in this region.

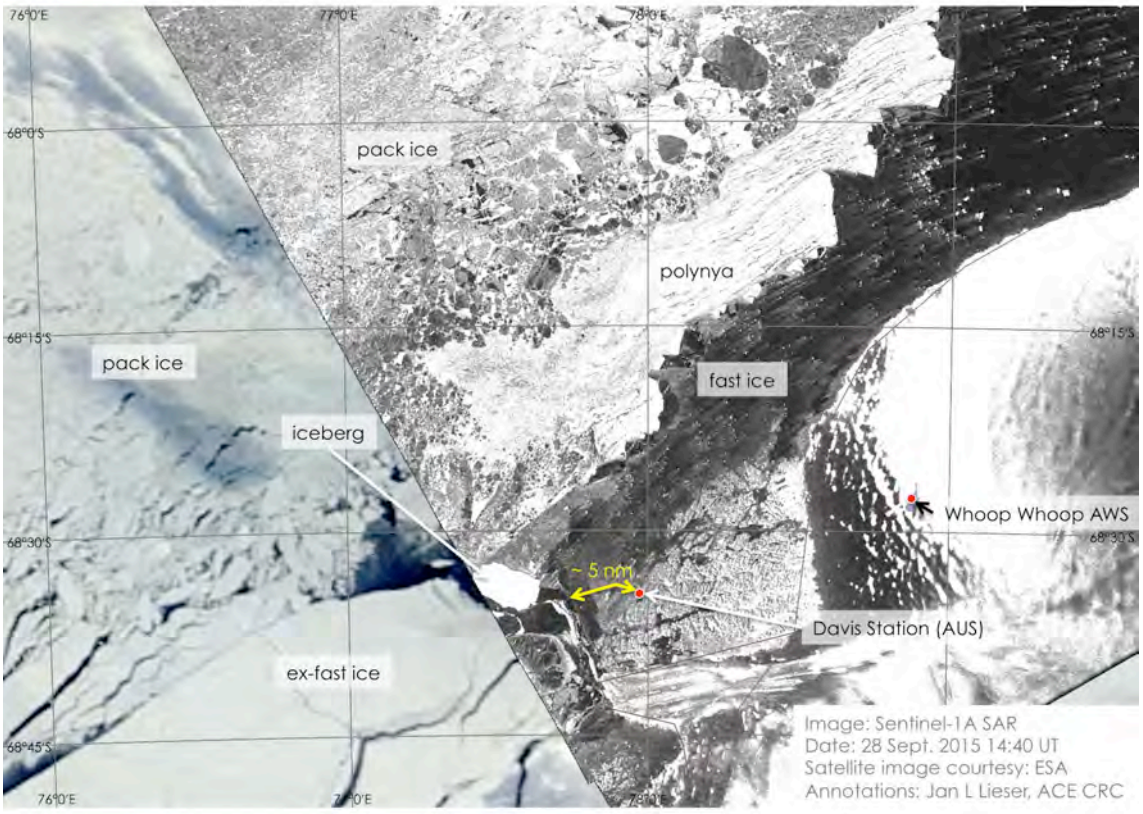

Figure 1: Sentinel-1a SAR scene, acquired 28/09/2015 and provided by ESA.

Figure 1 shows a high-resolution SAR scene on top of yesterday's Terra MODIS image. The iceberg off Davis Station (see Sea Ice Report #36.1) appears to be less swivelling. Its area is nearly 40 km^2 and fast ice has reached the berg's northern flank. Around the southern perimeter of this iceberg, a small polynya can be seen between ex-fast ice that recently broke away from the Christensen Coast and fast ice off the station. The distance from this polynya to Davis Station is approximately 5 nautical miles.

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Off the West Ice Shelf (not shown in Figure 1), the rift across iceberg D-15 is still widening very slowly (up to 700 m in the northern part of the rift).

With best regards,

Jan.

Sea Ice Report #41.1/2015

by the AAD/ACE CRC Sea Ice Group*

06/10/2015

During the first week of October, in East Antarctica, sea-ice extent follows closely the long-term (1981-2010) median extent for October. The pack ice of the region is classified as predominantly first-year sea ice, with only minor old ice inclusions.

This report considers sea-ice conditions off all Australian Antarctic bases.

- **Mawson Station**
  Fast ice off Mawson Station shows its typical shape for the time of year. Figure 1 provides a high-resolution impression of the fast ice between the station and the nearest open water in the northwest, approximately 40.5 nautical miles away.

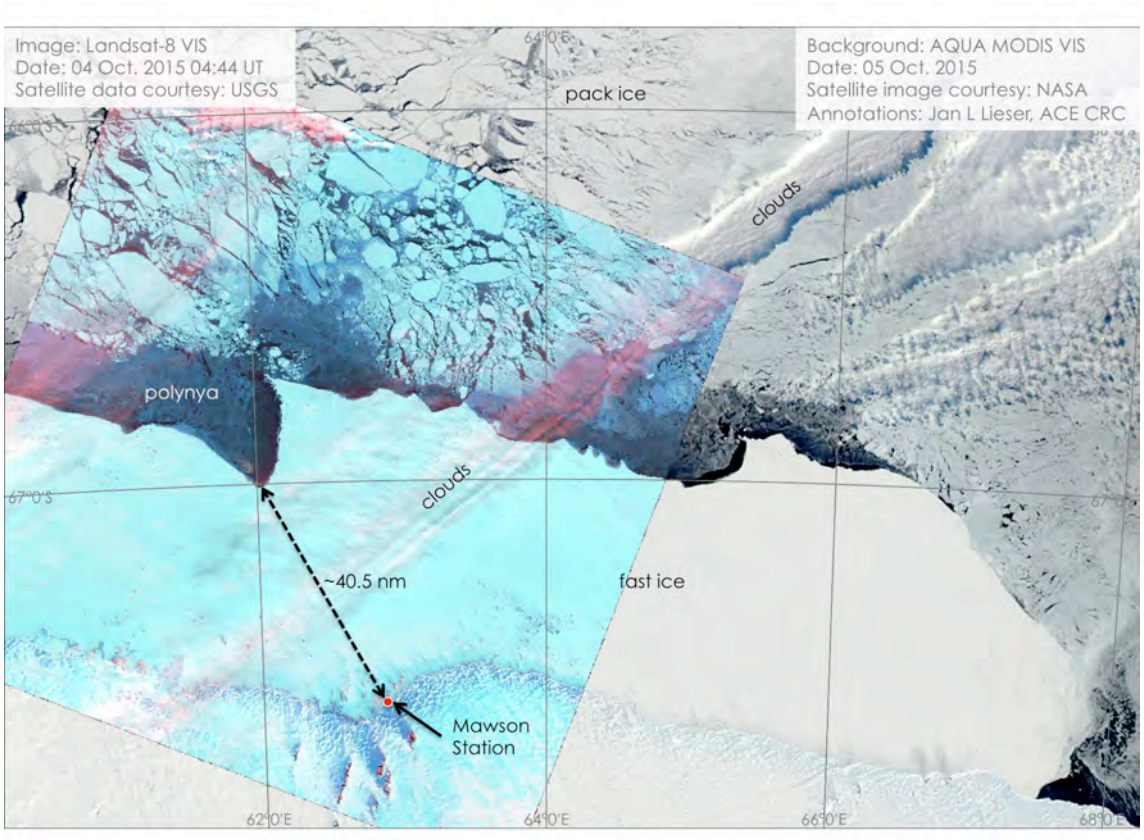

Figure 1: Landsat-8 scene, acquired 04/10/2015 and provided by USGS. Background: MODIS VIS scene, acquired 05/10/2015 and provided by NASA.

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- **Davis Station**
  The general sea-ice conditions off Davis Station have not changed significantly, during the past week. A large iceberg is still grounded approximately 8 nautical miles offshore. Southwest of the station, ex-fast ice has moved slightly to the northwest, away from the coastline.

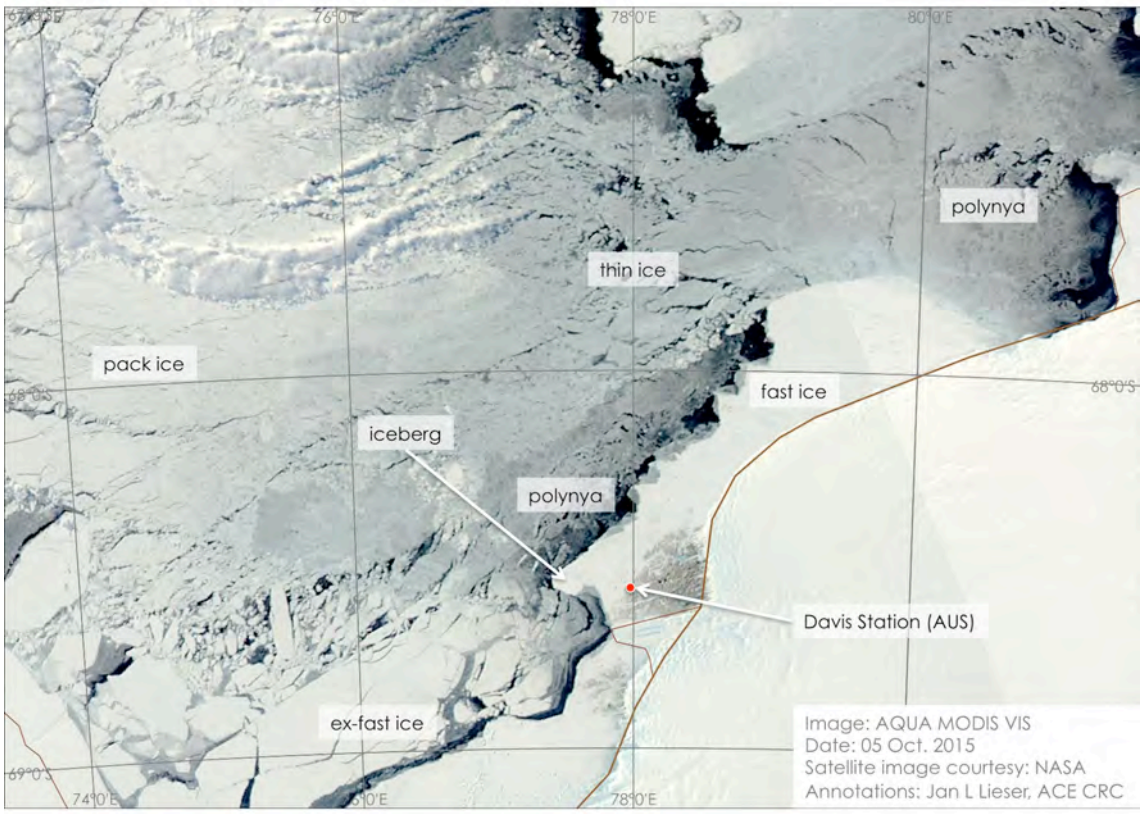

Figure 2: MODIS VIS scene, acquired 05/10/2015 and provided by NASA.

- **Casey Station**
  North of Casey Station, the sea-ice edge is approximately 335 nautical miles offshore and aligns with the long-term median extent.

  At the northwestern side of Law Dome, fast ice is attached to the coast and a polynya stretches from its northern end (65° 25' S, 109° 53' E) along the western fast ice edge towards the coast at Casey Station (Figure 3).

- **Commonwealth Bay**
  Offshore Commonwealth Bay, icebergs B-9B and C-15 are shifting through the sea ice and colliding occasionally, creating a lot of broken floes and ice rubble. For example, B-9B has moved approximately 2 km in northeast-southwest direction (along its long axis), between 30/09/15 and 03/10/15, followed by a 2 degree anticlockwise rotation (between 03/10/15 and 05/10/15).

The fast ice inside the bay remains stable at this stage and the fast-ice edge is about 9 nautical miles off the coastline.

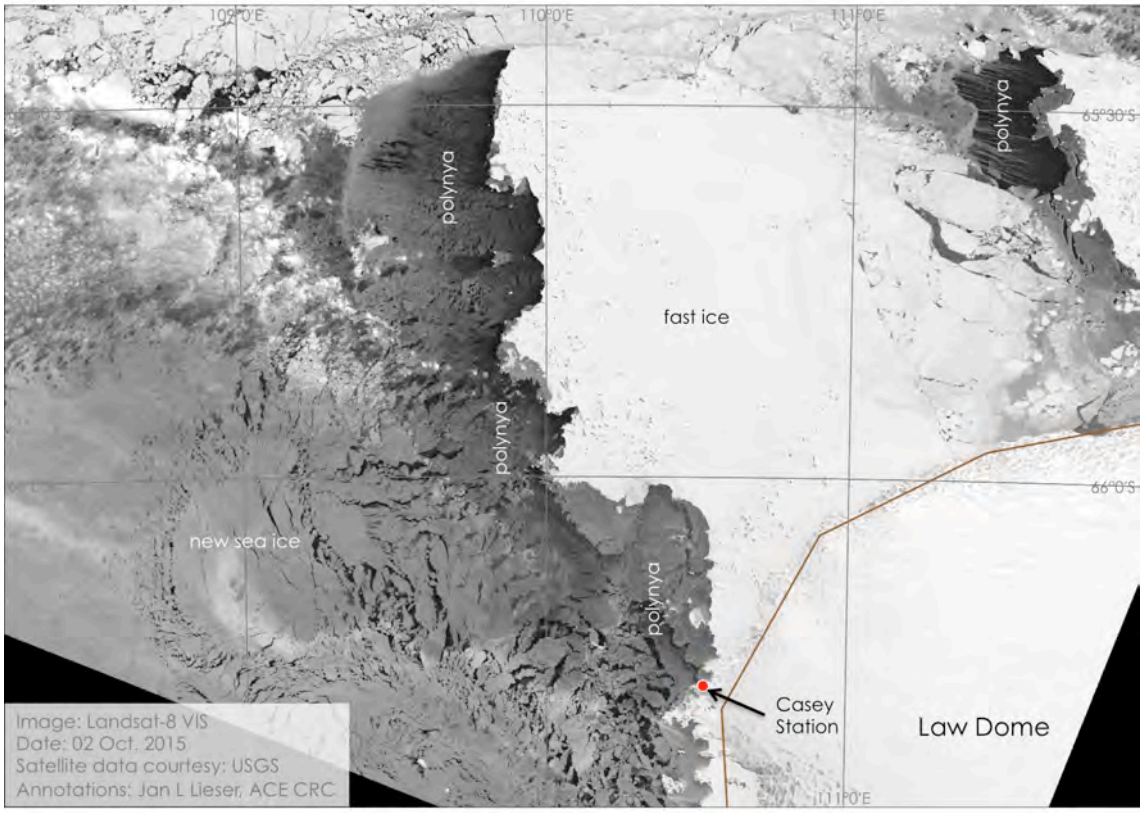

Figure 3: Landsat-8 VIS scene, acquired 02/10/2015 and provided by NASA.

With best regards,

Jan.

Sea Ice Report #42.1/2015

by the AAD/ACE CRC Sea Ice Group*

12/10/2015

- **Davis Station**
  Figure 1 shows a very high-resolution visible image of Davis Station and the fast ice offshore. Lots of smaller icebergs can be clearly identified surrounded by fast ice. The large tabular iceberg (annotated in the figure) measures approximately 5 nautical miles by 2.5 nautical miles. Recent fast ice accumulation towards the berg is marked by the yellow dashed lines (to the south and west of the line).

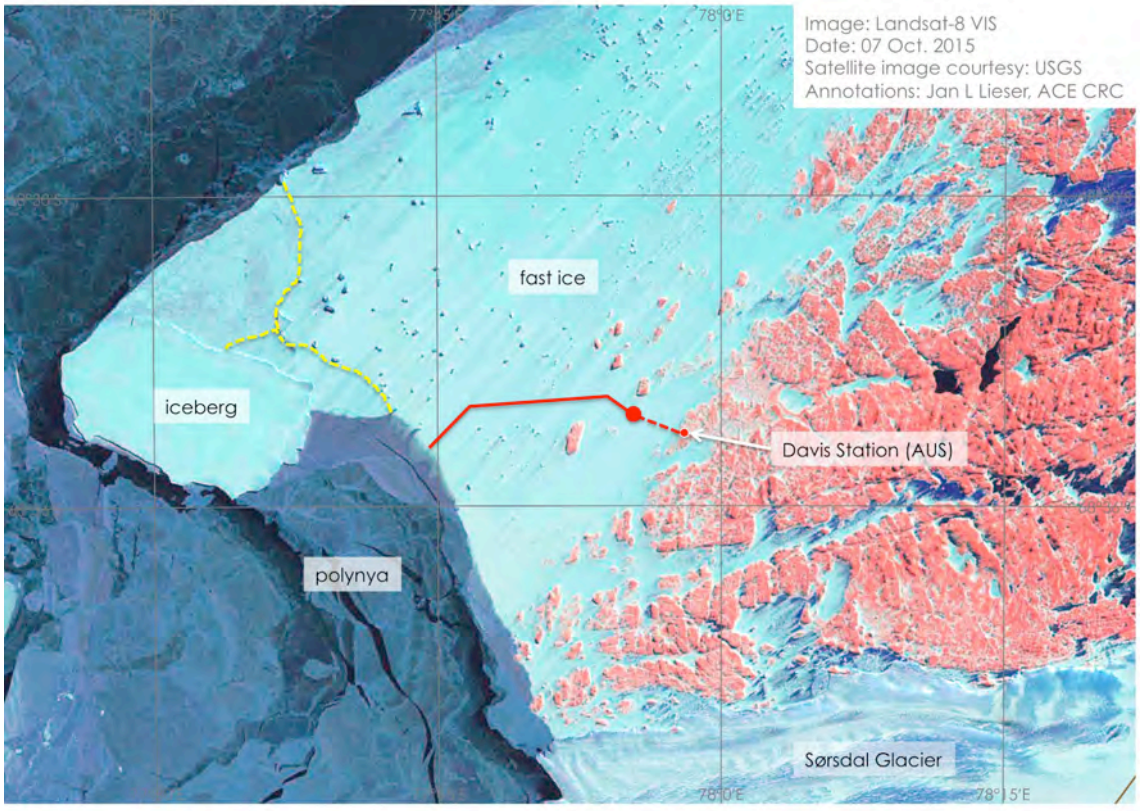

Figure 1: Landsat-8 VIS scene, acquired 07/10/2015 and provided by USGS.

The red line across the fast ice indicates a roughly 5.5 nautical miles long track towards a location approximately 1 nautical mile offshore from the station (red dot).

With best regards,

Jan.

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Sea Ice Report #42.2/2015

by the AAD/ACE CRC Sea Ice Group*

13/10/2015

In September 2015, we observed below average sea-ice concentration in large parts of Antarctica, particularly in the eastern Ross Sea (Figure **??**). In fact, with the exception of the Bellingshausen and Amundsen seas (between 60° W and 130° W), the sea-ice extent was also below (south of) the long-term average in Antarctica (black line in figure).

Regions of above average sea-ice concentration were located in the Bellingshausen and Amundsen seas, and to a lesser degree in the southern Indian Ocean (between 20° E and 50° E). In this Indian Ocean sector however, the anomalous high concentration was south of (below) the long-term average sea-ice extent for September.

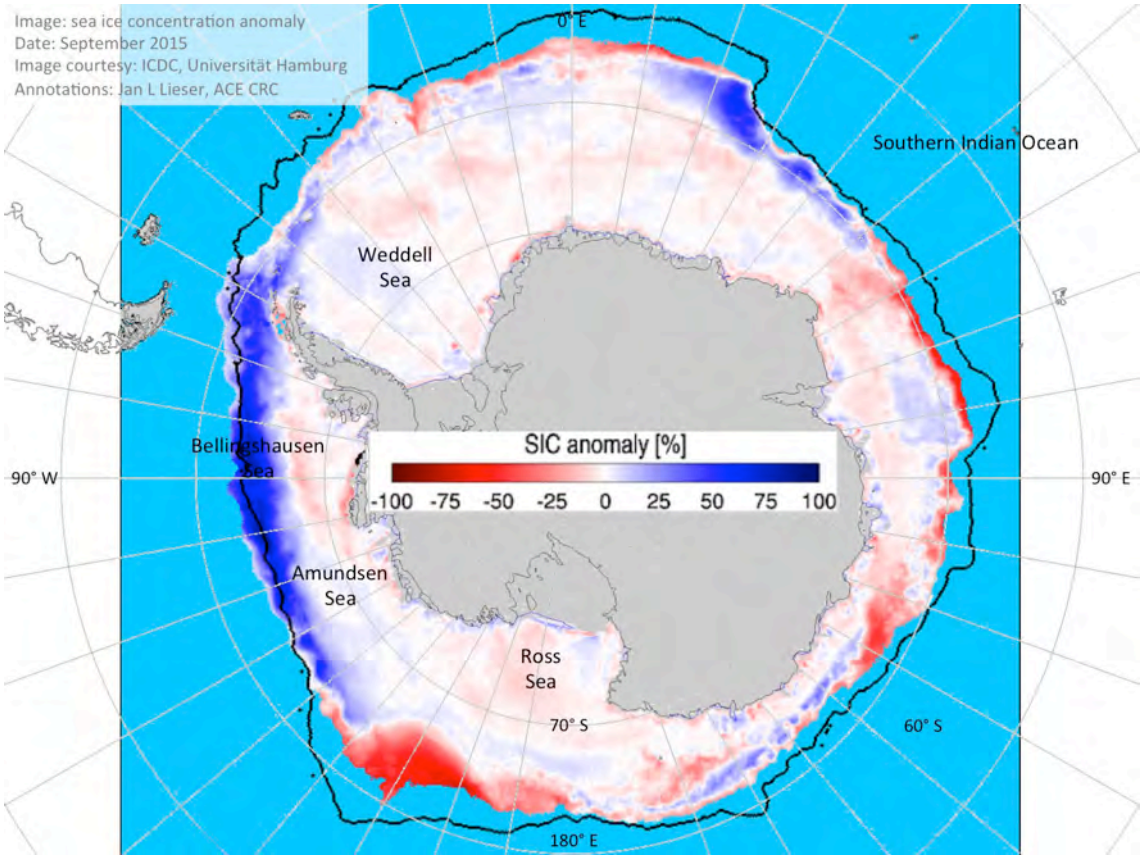

Figure 1: Sea-ice concentration anomaly for Spetember 2015. Image courtesy Integrated Climate Data Centre (ICDC), Universität Hamburg.

With best regards,

Jan.

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Sea Ice Report #43.1/2015

by the AAD/ACE CRC Sea Ice Group*

21/10/2015

- **Davis Station**
  Figure 1 shows a visible image of the Davis Station region, partly obscured by clouds. At the station, more fast ice has accumulated offshore around the large tabular iceberg (annotated in the figure). The distance between a potential over-ice resupply position and the western fast ice edge (indicated by the yellow arrow) is now circa 9 nautical miles, while the distance towards the southern fast ice edge (indicated by the blue arrow) is now approximately 7 nautical miles, because more fast ice accreted between the berg and the Sørsdal Glacier, during the last week.

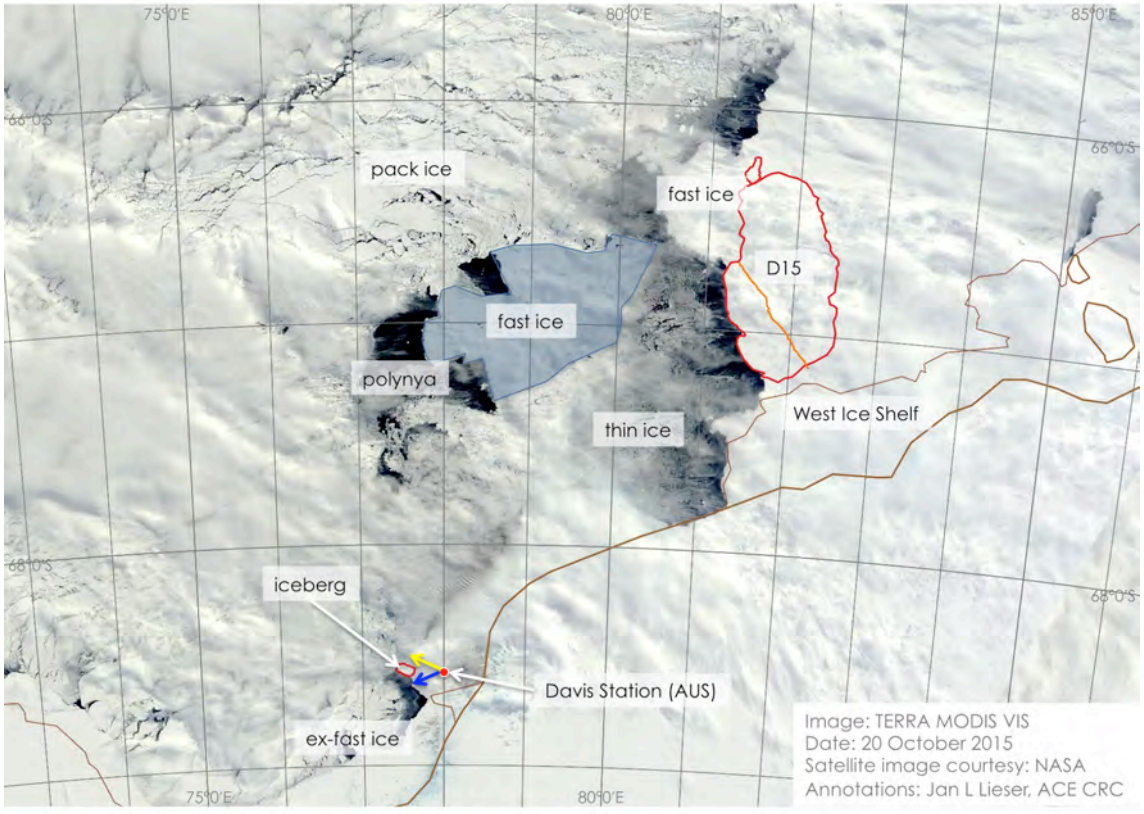

Figure 1: MODIS VIS scene, acquired 20/10/2015 and provided by NASA.

North of Davis Station, the blue shaded area of Figure 1 indicates fast ice that has grown between grounded icebergs at Four Ladies Bank (78° E and 67° S) and which accumulated more ice upstream

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(towards iceberg D15). This fast ice appears to be not attached to any land or ice shelf feature.

North of the West Ice Shelf, the rift across the southwestern part of iceberg D15 is indicated by an orange line. The northern part of that rift is now roughly 800 m wide, and the southern end of the rift can clearly be traced through the multi-year fast ice between D15 and the ice shelf.

With best regards,

Jan.

Sea Ice Report #43.2/2015

by the AAD/ACE CRC Sea Ice Group*

23/10/2015

- **Commonwealth Bay**
  On 19/10/2015, iceberg B-9B broke into two large pieces. The new fragment is annotated B-9x in Figure 1 and has an area of roughly 240 km^2 (about twice the area of Maria Island, Tasmania). It is large enough to be named and tracked by the US National Ice Center (likely B-9I).

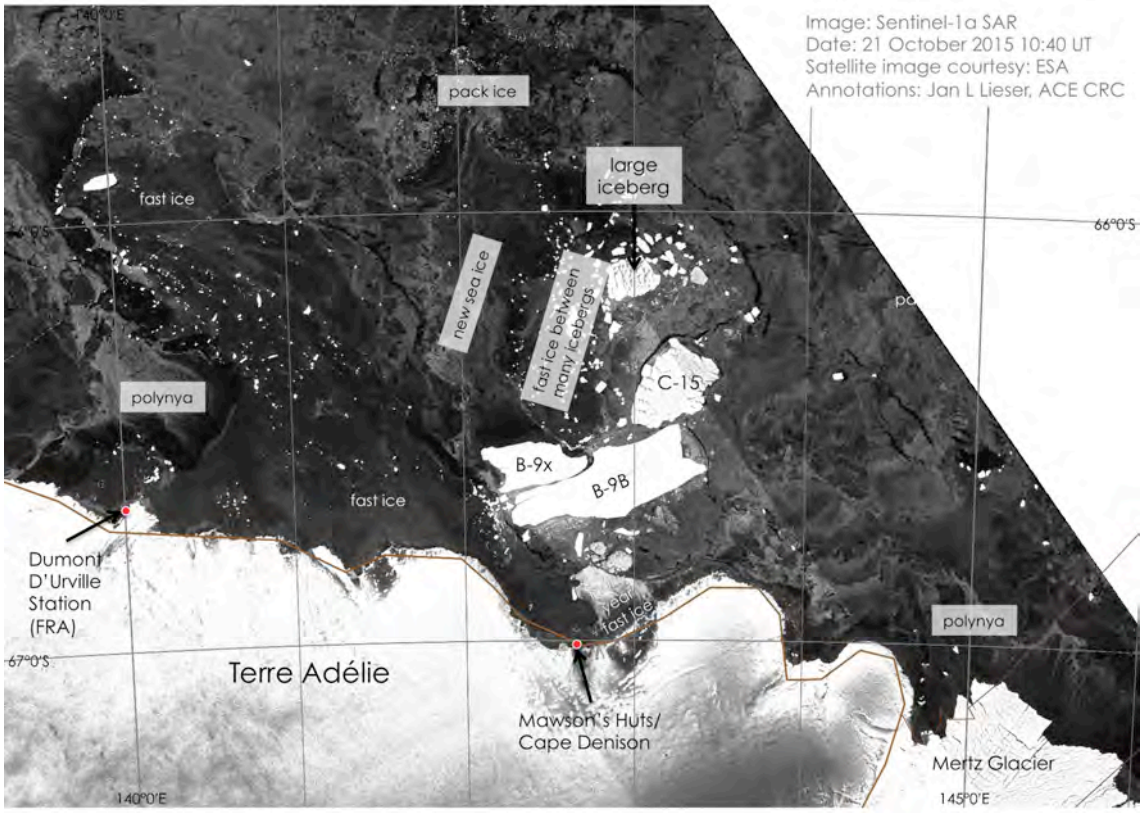

Figure 1: Sentinel-1a SAR scene, acquired 21/10/2015 and provided by ESA.

B-9x has now entered the polynya/new sea-ice area west of the fast ice between B-9B and the large berg in the north. The remaining B-9B is still moving in all directions and does not seem to be rigidly grounded. C-15 continues to move around as well but appears to be caught on the eastern side of this fast ice.

The overall shape of the landlocked fast ice between Dumont D'Urville Station and Commonwealth Bay has not changed

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significantly (Figure 2). North of the French station, the fast-ice edge is located approximately 8 nautical miles away; north of Mawson's Huts the fast-ice edge is roughly 10 nautical miles away.

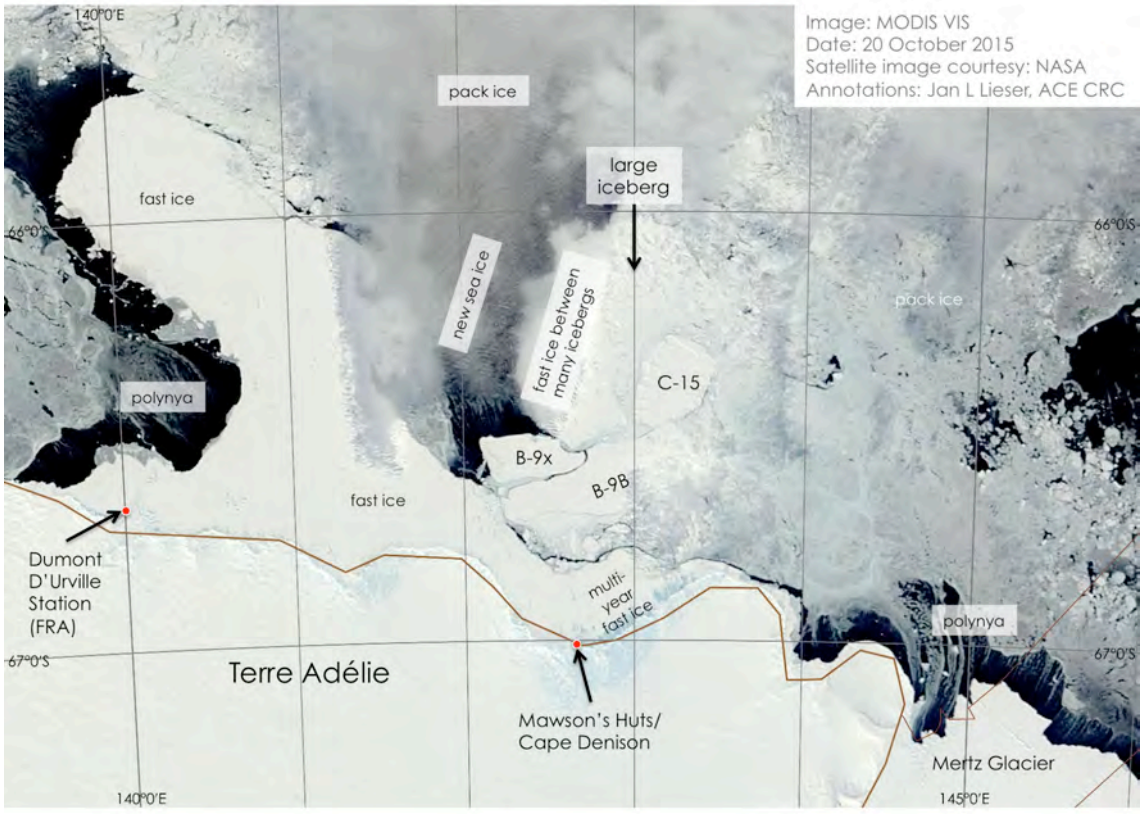

Figure 2: MODIS VIS scene, acquired 20/10/2015 and provided by NASA.

With best regards,

Jan.

Sea Ice Report #43.3/2015

by the AAD/ACE CRC Sea Ice Group*

23/10/2015

- **Davis Station**
  Figure 1 shows a high-resolution SAR scene of the Vestfold Hills and offshore Davis Station (with a MODIS VIS scene complementing the lower left corner). North and south of the iceberg, the fast-ice edge is given by a red scribble line. The fast-ice region between the iceberg and the station is characterised by four different surface textures, the boundaries between each is indicated by an orange scribble line. The texture differences reflect most likely different formation/accretion periods.

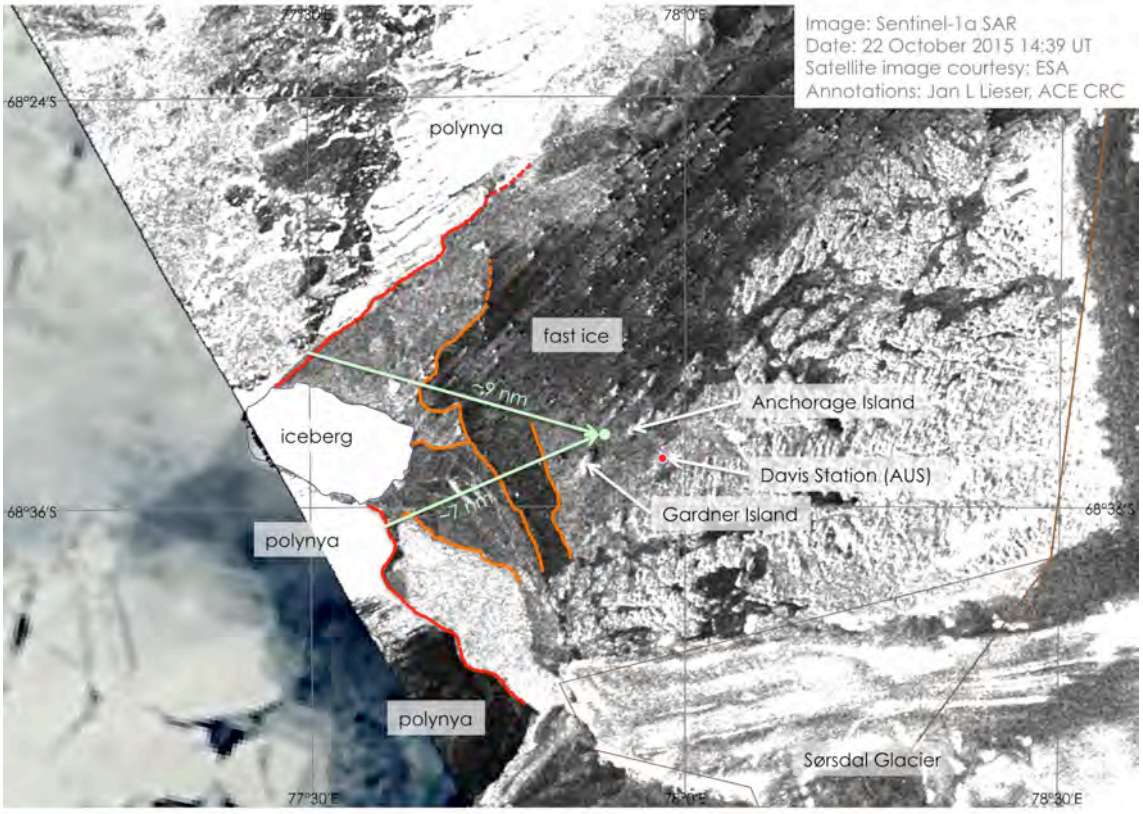

Figure 1: Sentinel-1a SAR scene, acquired 22/10/2015 and provided by ESA.

In light green, the distances between a potential resupply location (green dot) and the fast-ice edge to the west and south are given.

With best regards,

Jan.

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Sea Ice Report #45.1/2015

by the AAD/ACE CRC Sea Ice Group*

04/11/2015

- **Casey Station**
  The sea-ice zone off Casey Station shows a relatively wide (north-south) marginal ice zone with moderate sea-ice concentration. This marginal ice zone is about 100 nautical miles wide in the region of Figure 1 and highly dynamic. Overlain on the sea-ice concentration data of Figure 1 is a high resolution SAR scene, which allows for a better appreciation of the eddy structures of the marginal ice zone. South of the marginal ice zone is a band of about 100 nautical miles width (north-south) of very high sea-ice concentration, off the Shackleton Ice Shelf.

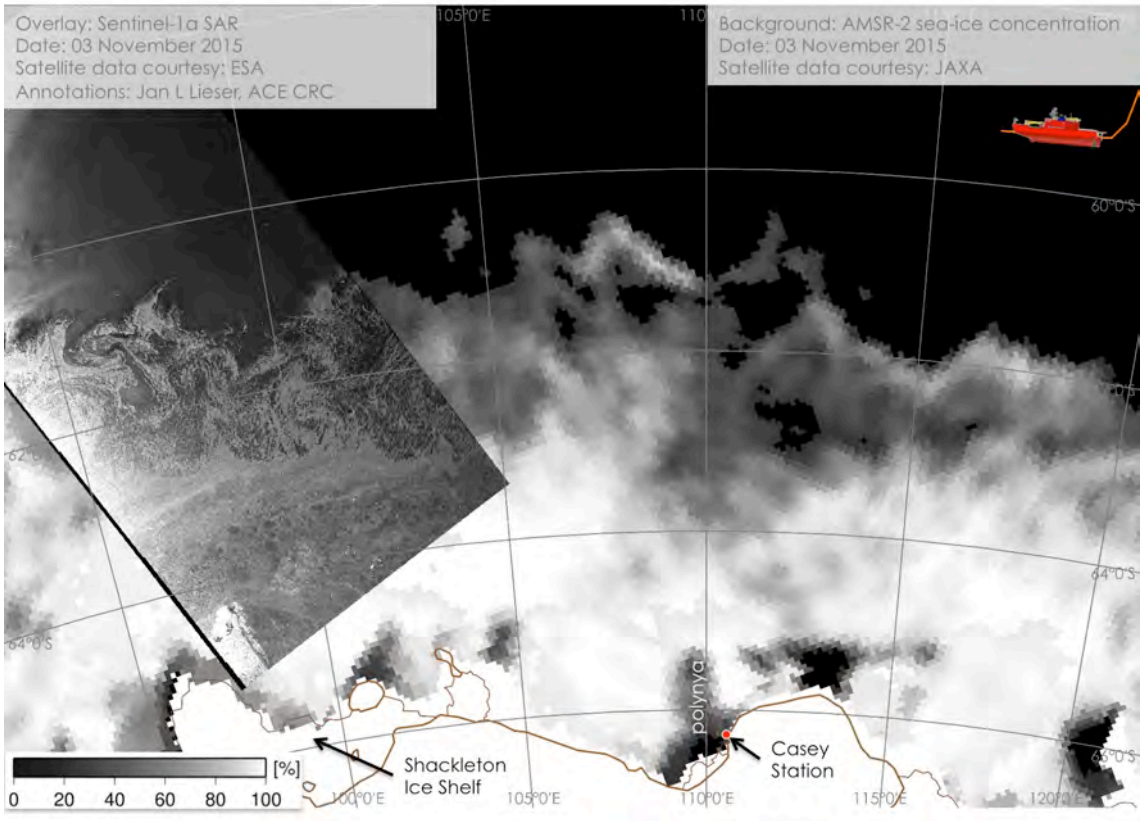

Figure 1: Sentinel-1a SAR scene, acquired 22/10/2015 and provided by ESA, overlain on AMSR-2 data, acquired 03/11/2015 and provided by Drift & Noise Polar Services.

The orange line (top right corner) shows the cruise track of RSV *Aurora*

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Australis in the region (up to 04/11/2015 00:00UT).

- **Commonwealth Bay**
  Off Commonwealth Bay, iceberg B-9I is drifting northward and away from the iceberg troika, north of Mawson's Huts (Figure 2). Icebergs B-9B and C-15 remain mobile but appear currently unable to leave the region.

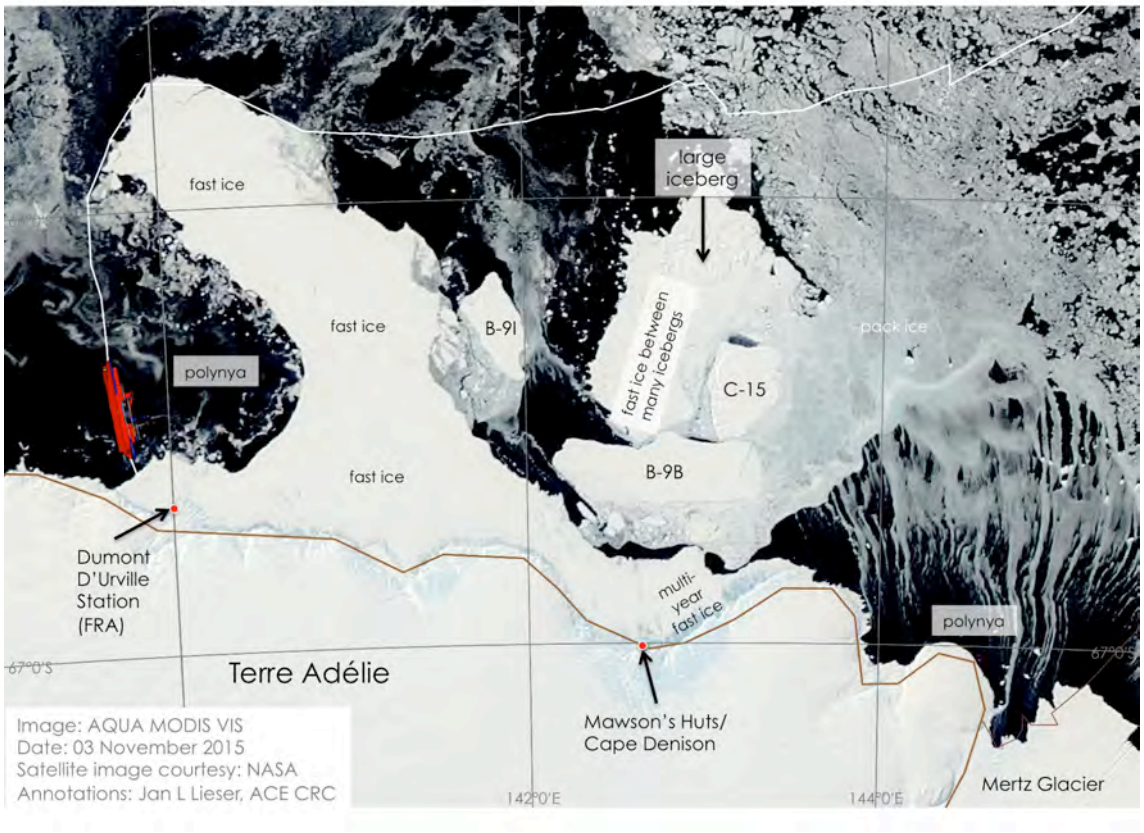

Figure 2: MODIS-VIS scene, acquired 03/11/2015 and provided by NASA.

The white line in Figure 2 denotes the cruise track of SV *l'Astrolabe*, which reached the fast-ice edge off Dumont D'Urville Station on 03/11/2015.

With best regards,

Jan.

Sea Ice Report #45.2/2015

by the AAD/ACE CRC Sea Ice Group*

05/11/2015

This report updates on fast-ice conditions off Davis Station.

- **Davis Station**
  The Vestfold Hills (Davis Station) are shown in the cloud free part of Figure 1. The fast ice off the station is retreating slowly towards the coast and the iceberg that was grounded and surrounded by fast ice west of the station is now free again and moving slightly (rotational movement). The distance between the fast ice edge and a potential resupply position off Davis Station (green dot) is approximately 7.5 nautical miles from the northwest and 4.5 nautical miles from the southwest (green arrows).

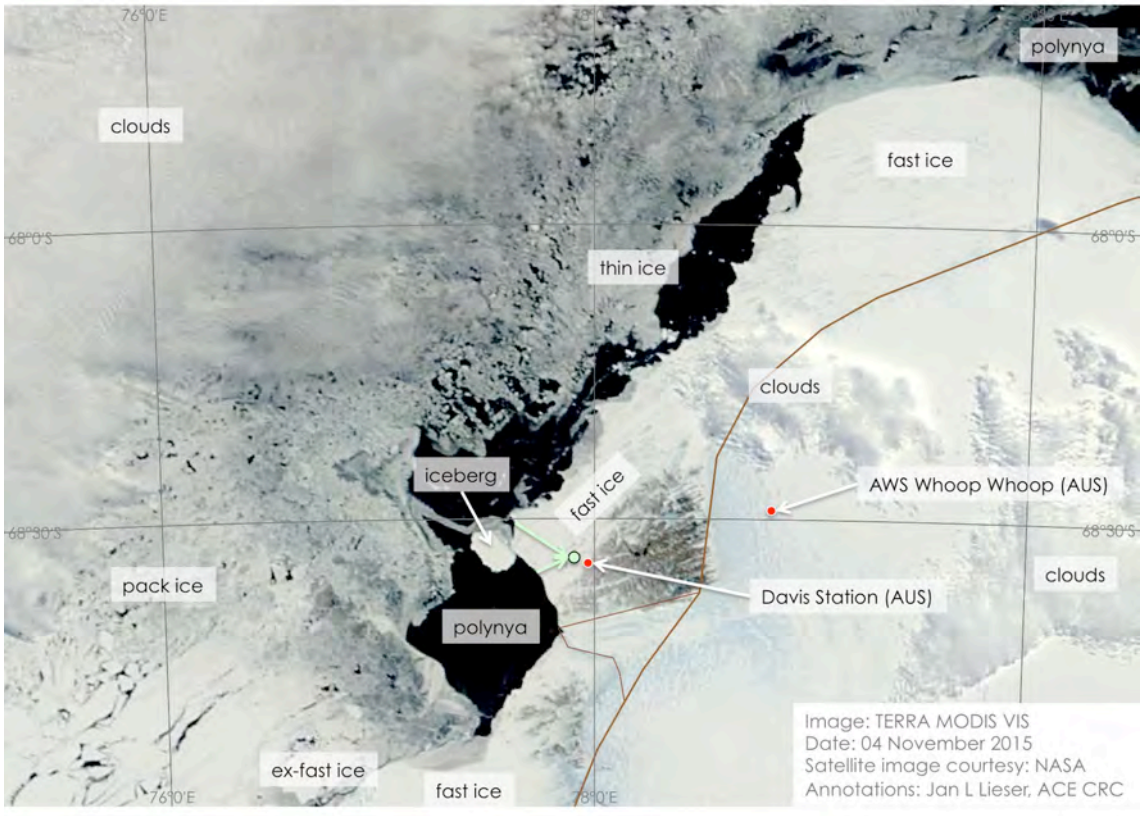

Figure 1: MODIS VIS scene, acquired 04/11/2015 and provided by NASA.

With best regards,

Jan.

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Sea Ice Report #45.3/2015

by the AAD/ACE CRC Sea Ice Group*

06/11/2015

This report updates on fast-ice conditions off Mawson Station.

- **Mawson Station**
  A high-resolution Operational Land Imager scene from Landsat-8 is shown in Figure 1 with a MODIS VIS scene in the background. The fast-ice edge displays its typical shape with a polynya northwest of the station, where the southern corner of the polynya is more than 40 nautical miles away from the station. 'Iceberg alley' can clearly be identified north of Mawson Station.

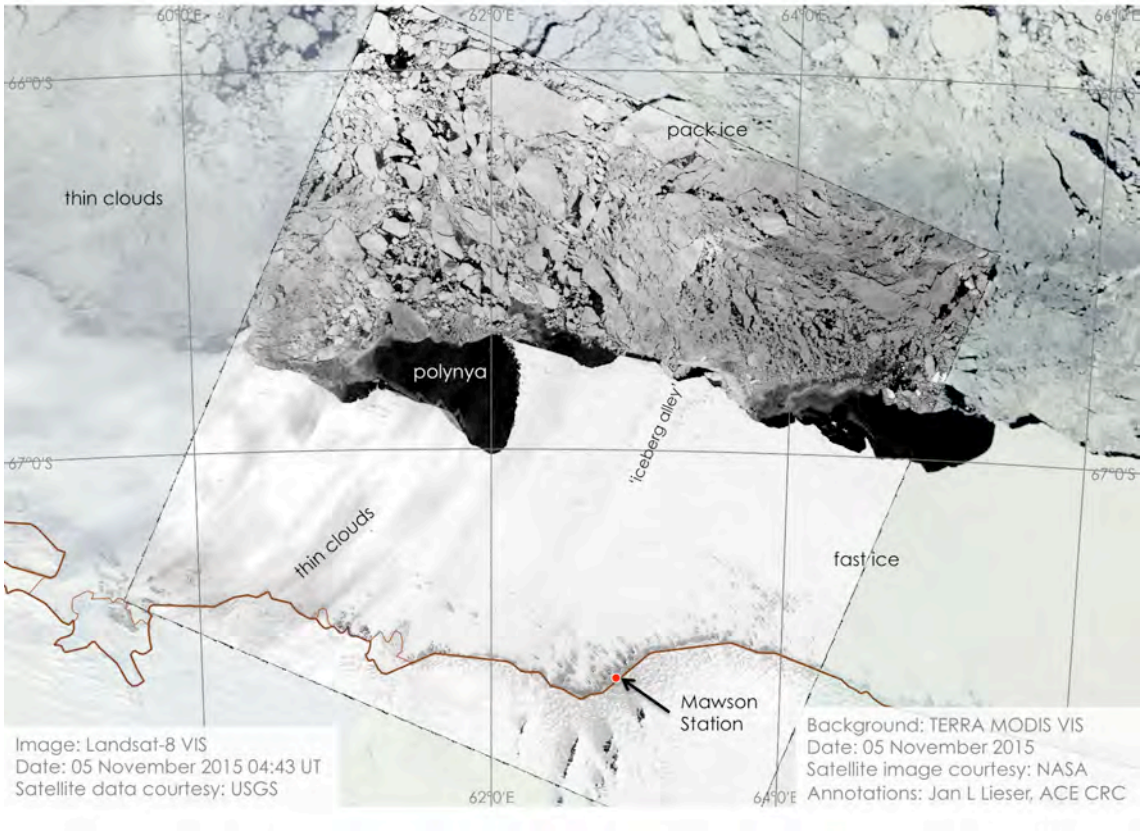

Figure 1: Landsat-8 OLI scene, acquired 05/11/2015 and provided by USGS. Background: MODIS VIS scene, acquired 05/11/2015 and provided by NASA.

North of the fast-ice edge, the pack ice is drifting freely and many cracks and leads are visible. Very large sea-ice floes show signs of breaking up.

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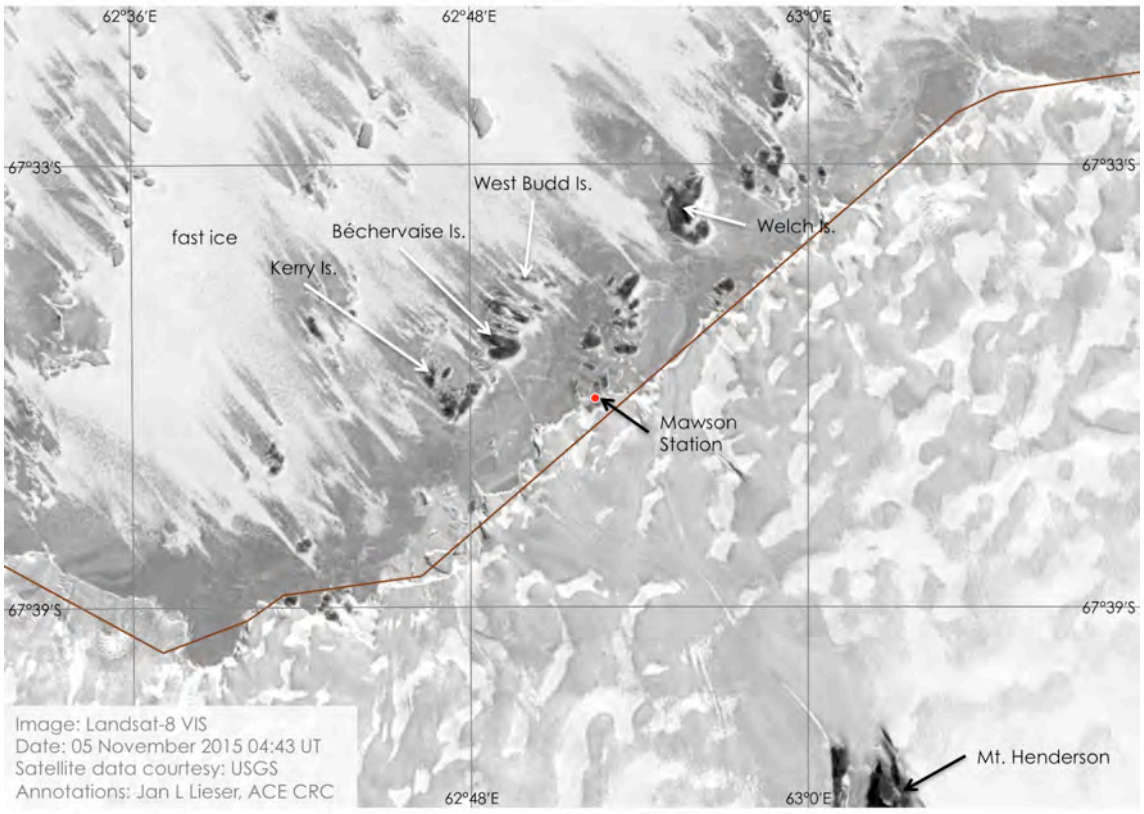

Figure 2: Landsat-8 OLI scene, acquired 05/11/2015 and provided by USGS.

Figure 2 allows for an appreciation of the detail contained in the OLI scene. Horseshoe Harbour (with the station at its southeastern corner) can clearly be identified as well as the offshore islands.

With best regards,

Jan.

Sea Ice Report #45.4/2015

by the AAD/ACE CRC Sea Ice Group*

06/11/2015

This report updates on sea-ice conditions off Casey Station.

- **Casey Station**
  Figure 1 provides a high-resolution (3.25 km) sea-ice concentration chart for the region between the Shackleton Ice Shelf and the Moscow University Ice Shelf. The long-term median sea-ice extent for October and November is given by the orange and green line, respectively. The cruise track of RSV *Aurora Australis* (up to 06/11/2015 04:00 UT) is shown in red.

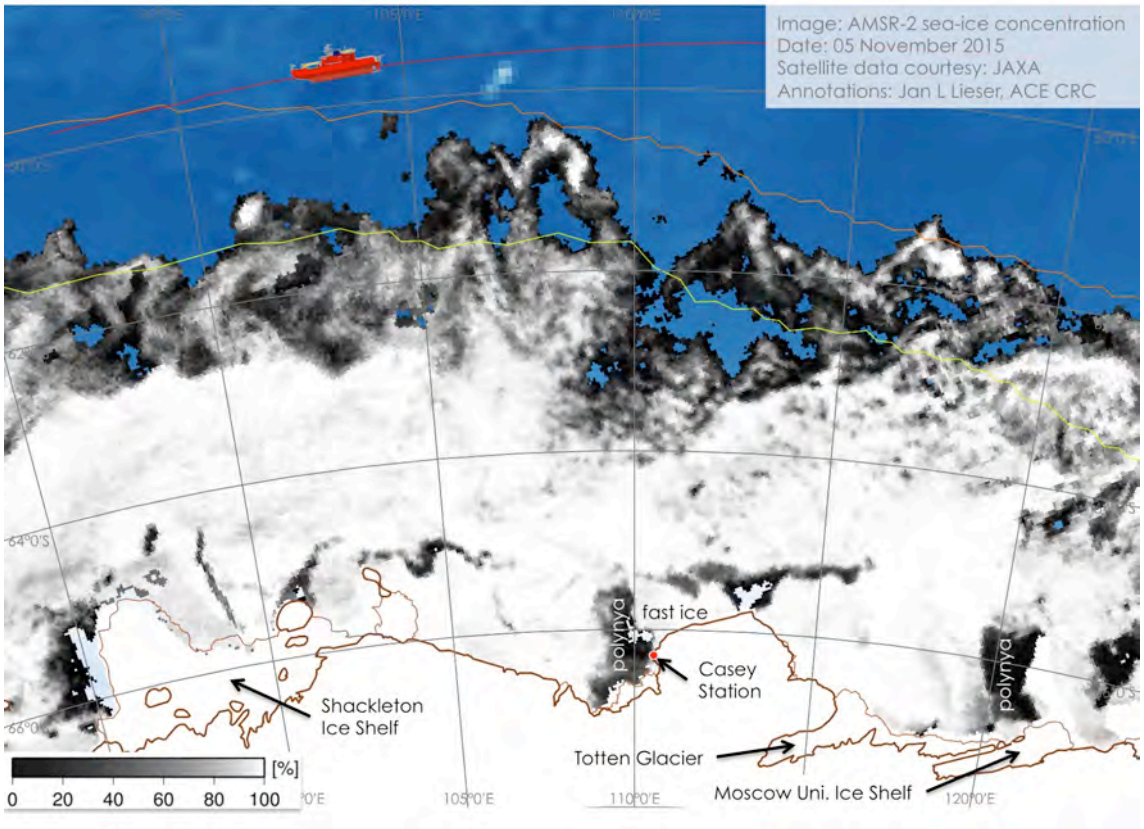

Figure 1: AMSR-2 sea-ice concentration, acquired 05/11/2015 and provided by Univerität Hamburg.

The sea-ice edge has largely retreated to the extent of the November median, west of Casey Station. North of the station, the marginal ice zone has reached 64° S and a band of high concentration pack ice is

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only about 75 nautical miles wide (north-south) between the polynya off Casey Station and the marginal ice zone.

With best regards,

Jan.

Sea Ice Report #46.1/2015

by the AAD/ACE CRC Sea Ice Group*

09/11/2015

- **Davis Station**
  Figures 1, 2 and 3 show the same geographical frame, north of Davis Station, as seen in the microwave (AMSR-2), visible and RADAR (SAR) frequency spectrum, respectively, The figures show increasing spatial resolution, with the AMSR-2 data are at 6.5 km, the visible data at 250 m and the SAR data at ~30 m. The cruise track of RSV *Aurora Australis* (up to 09/11/2015 00:00 UT) is shown as an orange line (top right corner). The black lines in Figure 1 denote boundaries of different sea-ice regimes, as classified by the US National Ice Center, on 05/11/2015. It is highly likely that the current boundaries of these zones have shifted slightly in the meantime, but it allows for a general appreciation of the sea-ice conditions, ahead of the vessel.

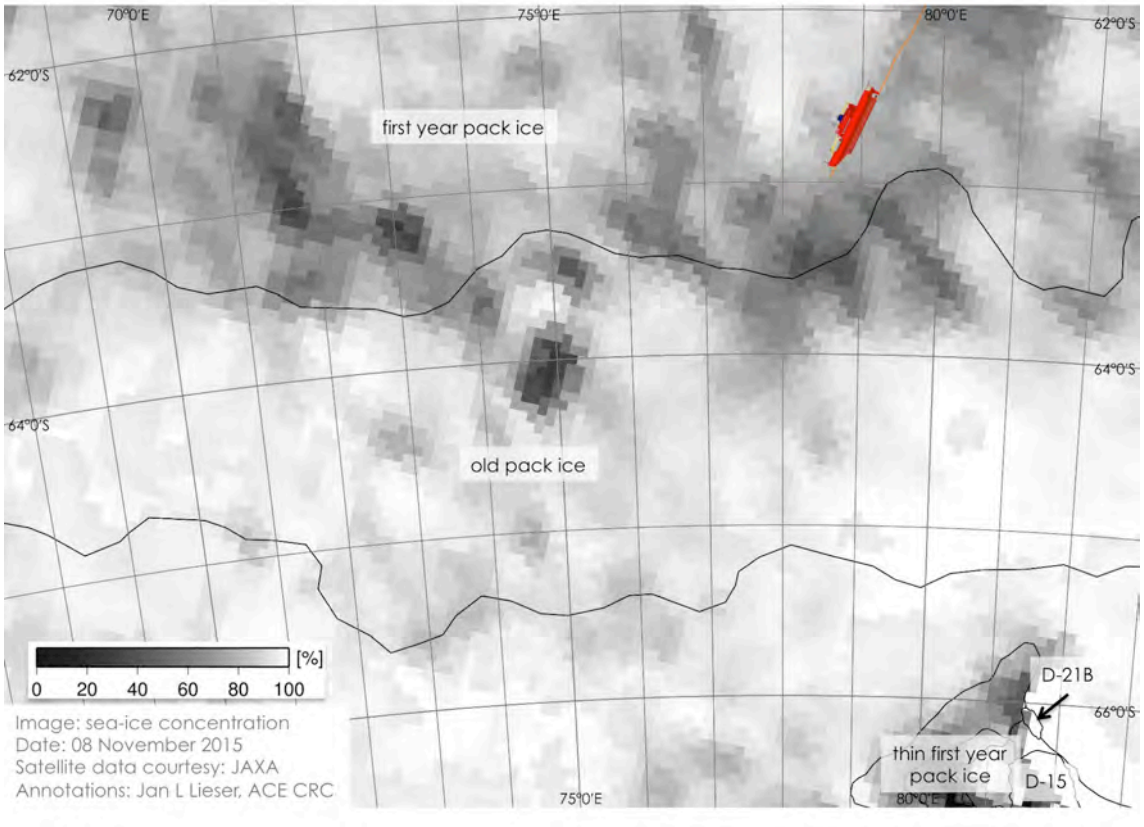

Figure 1: AMSR-2 sea-ice concentration, acquired 08/11/2015 and provided by Drift & Noise Polar Services.

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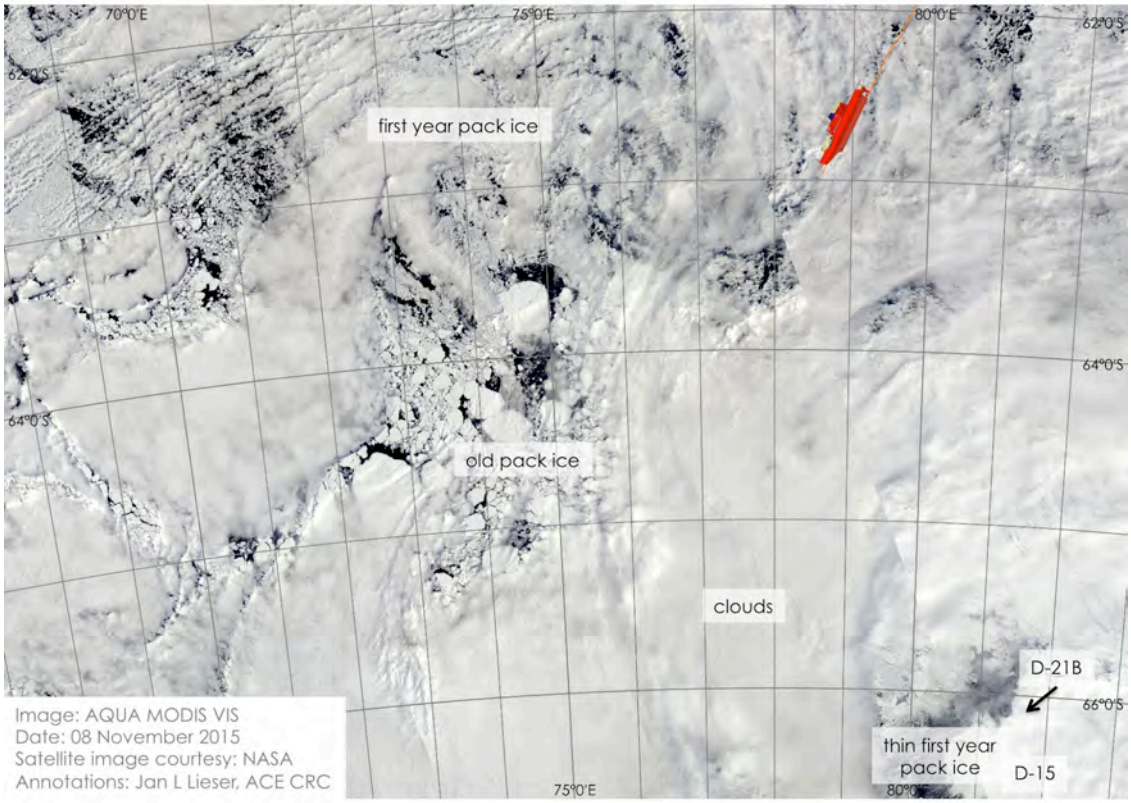

Figure 2: MODIS VIS scene, acquired 08/11/2015 and provided by NASA.

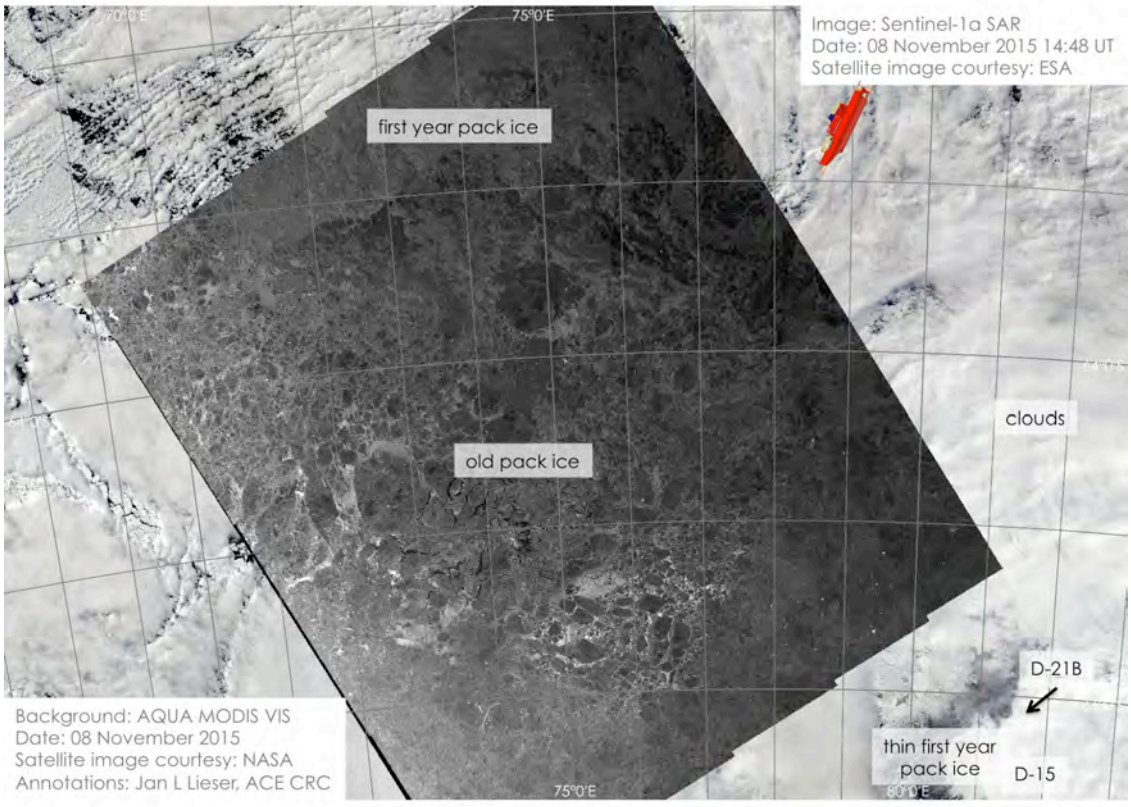

Figure 3: Sentinel-1a SAR scene, acquired 08/11/2015 and provided by ESA.

RSV *Aurora Australis* is heading into an area where sea ice older than one year is present. This band of old sea ice is about 120 nautical miles wide (north-south) and the higher resolution maps (visible and SAR) clearly show large patches of open water between those old ice floes. Overall, the sea ice in the region appears to be under low horizontal stress, at the moment.

With best regards,

Jan.

Sea Ice Report #46.2/2015

by the AAD/ACE CRC Sea Ice Group*

10/11/2015

This report updates on fast-ice conditions around Commonwealth Bay.

- **Commonwealth Bay**
  Figures 1 and 2 show the same geographical frame offshore Terre Adélie, between Dumont D'Urville Station and Mawson's Huts. The two scenes were acquired three days apart and show a rapid reduction of landfast sea ice in the area. Between 06/11/15 and 09/11/15, roughly 1500 km^2 of ice has broken off from the hook-shaped fast-ice feature between Liotard Glacier, west of Dumont D'Urville Station, and Cape Gray, east of Commonwealth Bay. At the same time, iceberg B-9I has travelled about 20 nautical miles northwestward and rotated almost 180°.

  The cruise track of SV *l'Astrolabe* (up to 10/11/2015 02:30 UT) is shown as a red line, in both figures. It is obvious that the vessel had to relocate after the fast ice break out. The distance between the fast ice edge and Dumont D'Urville Station was less than 7 nautical miles on 06/11/15 and is now approximately 2.5 nautical miles.

  The fast ice between iceberg B-9B and the large berg in the north (annotated) is also showing signs of retreat,

With best regards,

Jan.

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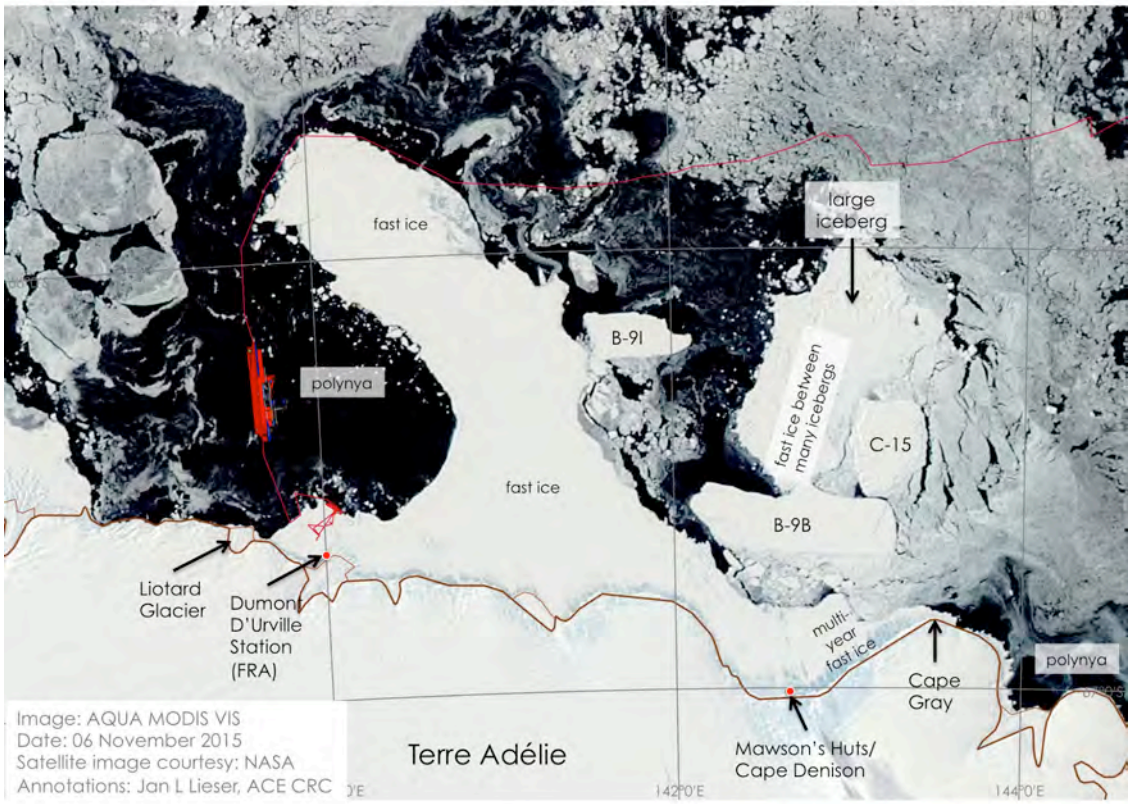

Figure 1: MODIS VIS scene, acquired 06/11/2015 and provided by NASA.

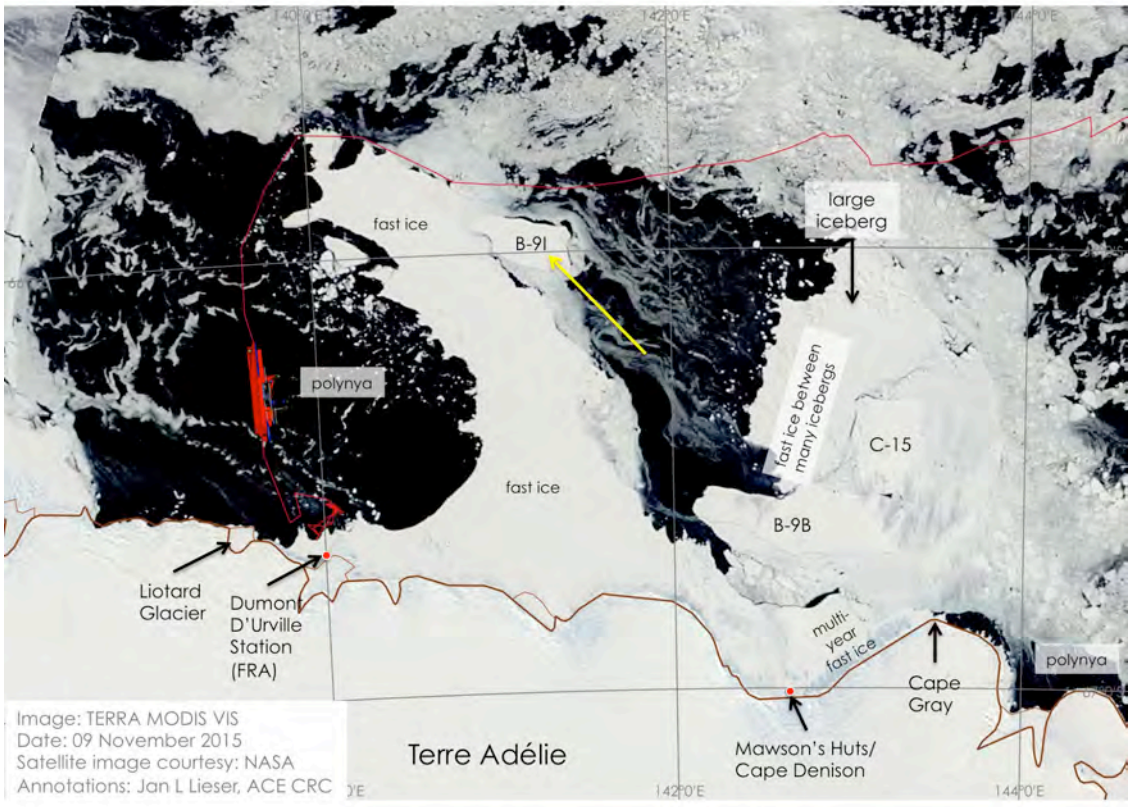

Figure 2: MODIS VIS scene, acquired 09/11/2015 and provided by NASA.

Sea Ice Report #46.3/2015

by the AAD/ACE CRC Sea Ice Group*

12/11/2015

This report provides an update on sea-ice conditions of the Ross Sea.

- **Ross Sea**
  After three consecutive years of extreme (high) sea-ice conditions, the late-winter/spring sea-ice extent overall in Antarctica and in the Ross Sea is around the long-term average again, in the eastern Ross Sea even slightly below average.

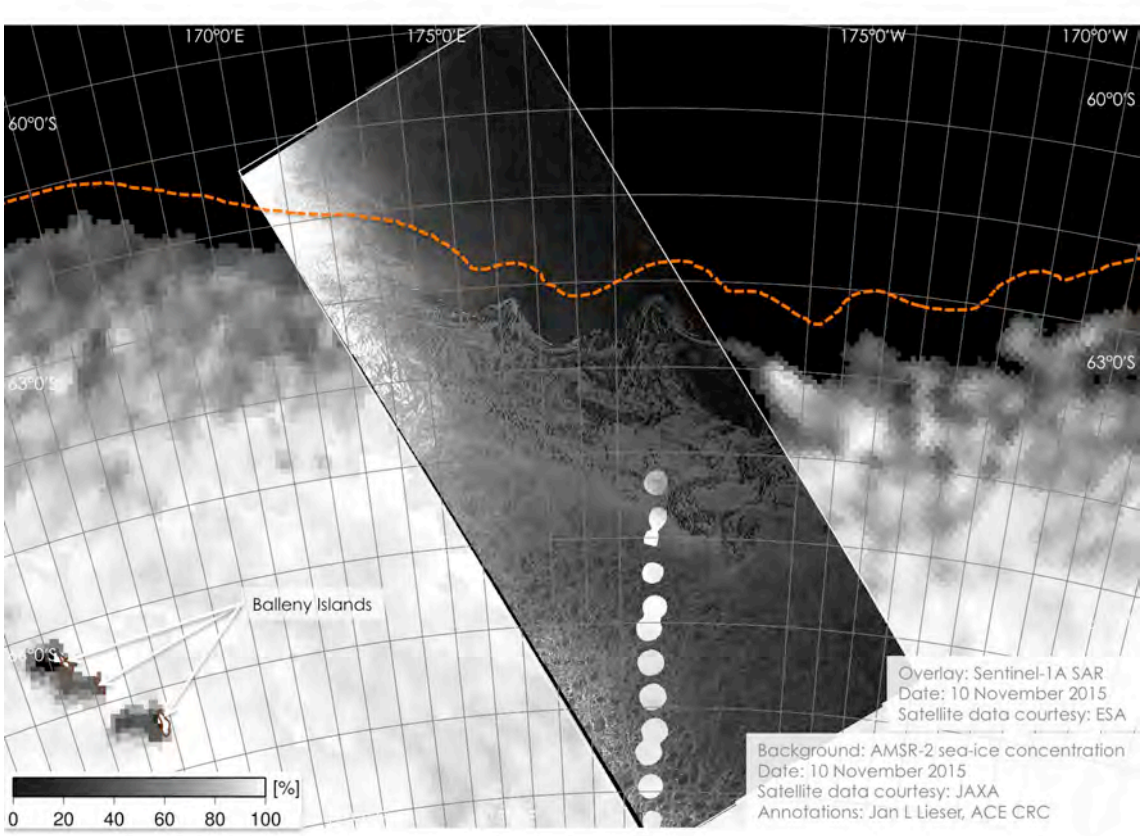

Figure 1: Sentinel-1a SAR scene, acquired 10/11/2015 and provided by PolarView. Background: AMSR-2 sea-ice concentration, acquired 10/11/2015 and provided by Drift & Noise Polar Services.

Figure 1 shows the current conditions as seen by the passive microwave instrument AMSR-2 (computed sea-ice concentration) with an overlay of synthetic aperture RADAR data (the circles/holes in the SAR data along the date line are a processing artefact). The good agreement of the two data sets is obvious. The orange

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dashed line in the figure denotes a boundary south of which sea ice occurrence can reasonably be expected. South of a line from about 65° S and 175° E to 66° S and 175° W, a band of high concentration old sea ice can be expected, roughly 60 nautical miles wide.

There are no very large (larger than 10 nautical miles across) tabular icebergs being tracked in the region, and small icebergs are undetected in microwave data. There are no icebergs visible in the SAR scene.

With best regards,

Jan.

Sea Ice Report #46.4/2015

by the AAD/ACE CRC Sea Ice Group*

13/11/2015

- **Ross Sea**
  Figure 1 shows yesterday's sea-ice concentration chart with an overlay of high resolution synthetic aperture RADAR data (circles/ holes in the SAR data along the date line are a processing artefact). Oceanographic fronts and monthly median sea-ice extent are also marked in the figure. Monthly median extents are calculated based on the minimum detectable sea-ice concentration of 15%.

  The dashed orange line shows a boundary south of which some sea ice can reasonably be expected.

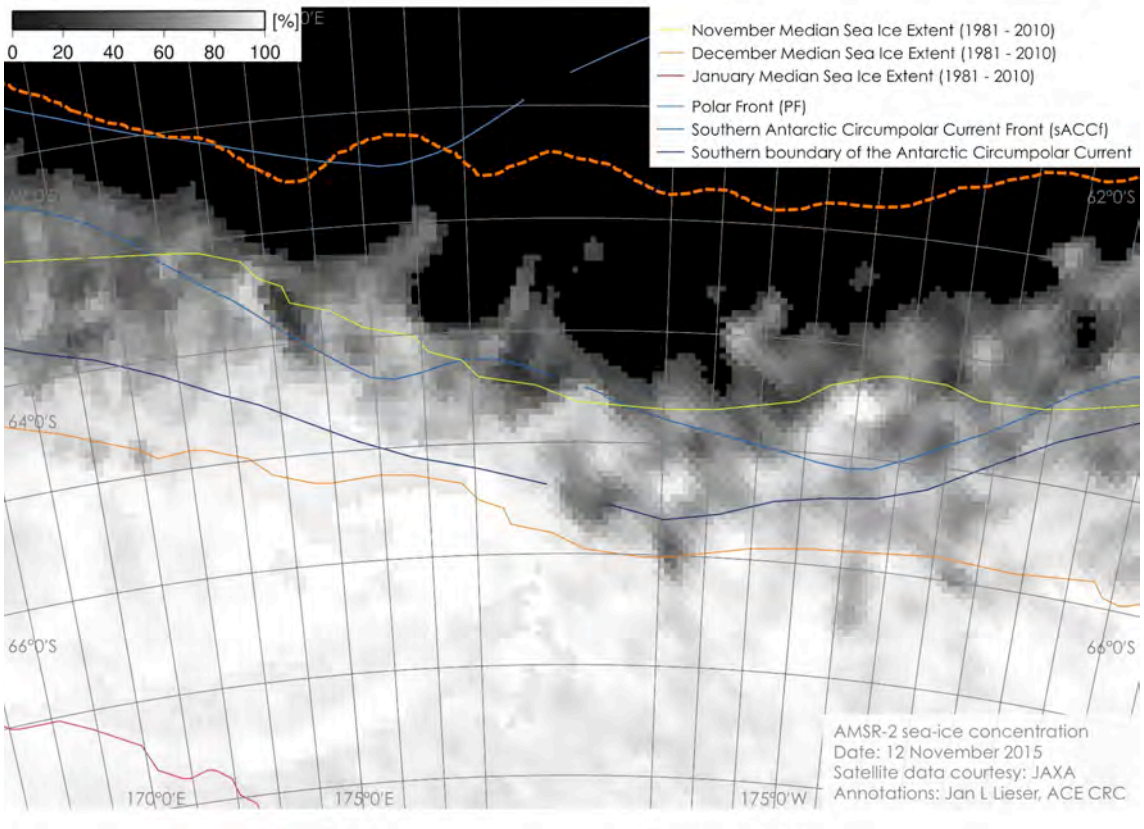

Figure 1: AMSR-2 sea-ice concentration, acquired 12/11/2015 and provided by Drift & Noise Polar Services.

While the sea-ice edge is generally retreating southward it is currently still north of the long-term median extent for November.

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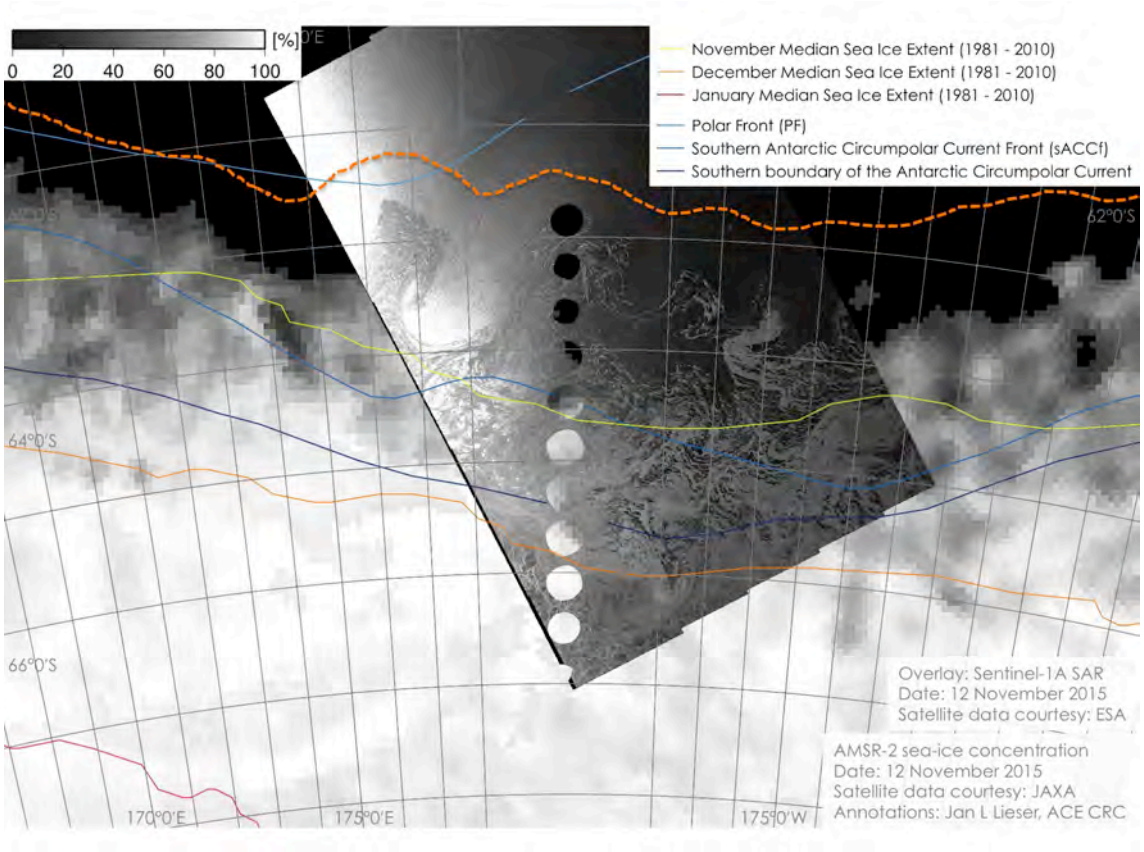

Figure 2: As for Figure 1, with overlay of Sentinel-1a SAR scene, acquired 12/11/2015 and provided by PolarView.

The addition of high-resolution Radar data in Figure 2 highlights the limits of passive microwave data (AMSR-2). Small-scale oceanographic eddies can transport only little sea ice to the north, out from the central pack, resulting in structures resembling filigree. Those structures can not be resolved in the sea-ice concentration charts.

With best regards,

Jan.

Sea Ice Report #46.5/2015

by the AAD/ACE CRC Sea Ice Group*

13/11/2015

- **Commonwealth Bay**
  A large part of the sea-ice zone shown in Figure 1 is obscured by clouds, but the continuing break-up of fast ice in the region is still detectable, most obvious at the northern end of the hook-like fast ice feature between Dumont D'Urville Station and Commonwealth Bay. The cruise track of SV *l'Astrolabe* (up to 13/11/2015 04:30 UT) is shown as a red line. The distance between the fast ice edge and Dumont D'Urville Station is now approximately 1 nautical mile.

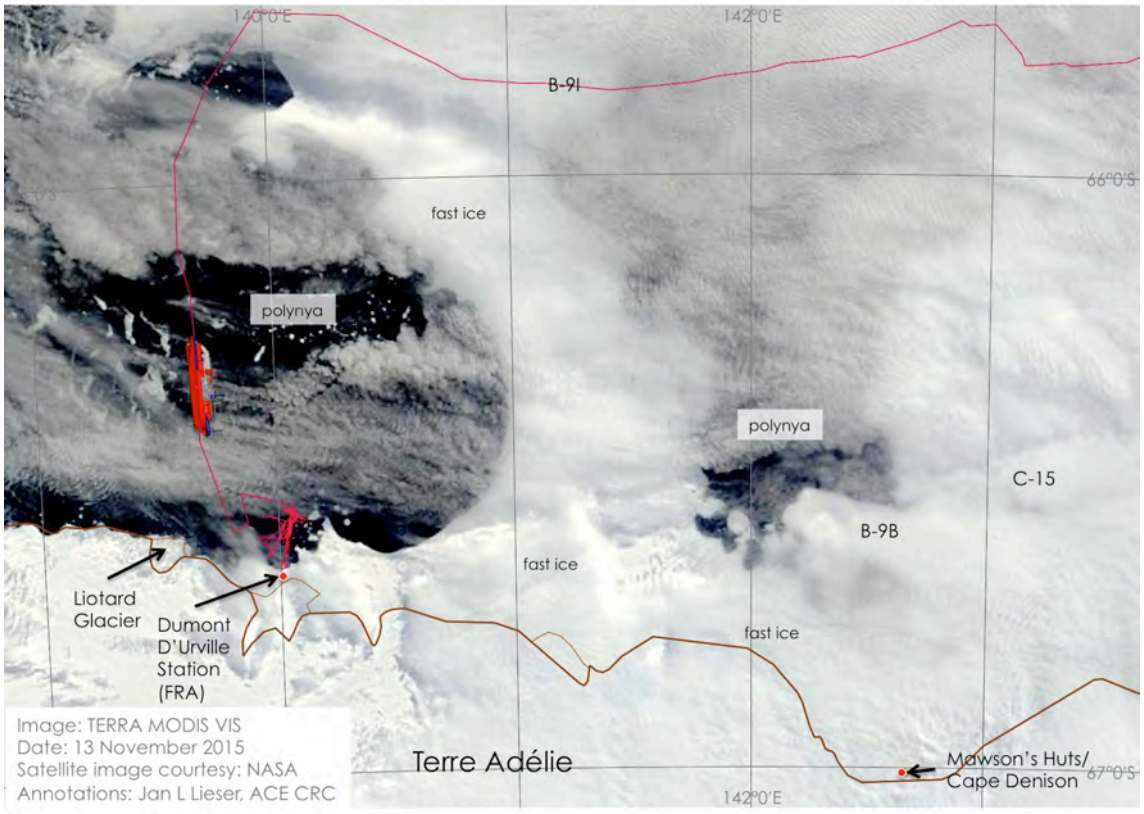

Figure 1: MODIS VIS scene, acquired 13/11/2015 and provided by NASA.

Iceberg B-9I has moved further northwards and B-9B has rotated slightly clockwise, since 09/11/15 (see Sea Ice Report #46.2/2015).

With best regards,

Jan.

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Sea Ice Report #47.1/2015

by the AAD/ACE CRC Sea Ice Group*

16/11/2015

This report examines sea-ice conditions off Davis Station and in Prydz Bay more generally.

- **Davis Station**
  Figures 1 and 2 show the same geographical frame, offshore Davis Station, at very high resolution as seen by the OLI sensor (Landsat-8) and SAR (Sentinel-1a), respectively. The track of RSV *Aurora Australis* breaking through the fast ice towards the station can be seen in both figures very clearly. Additionally, the SAR scene shows the locations of the station and the vessel as very bright (white) spots (very high backscatter signal). The SAR scene also reveals sections of different surface backscatter (as indicated by the yellow dashed lines) of the fast ice that the vessel had crossed on her way east. These sections relate most likely to different stages of development (and ultimately age) of this fast ice.

  Differing patterns of strips and patches of sea ice is explained by the time difference of the data acquisitions of Figures 1 and 2.

  Figures 3 to 6 show with increasing spatial resolution the same frame of the sea-ice zone of Prydz Bay (AMSR-2 data are at 6.5 km, MODIS visible at 250 m and SAR and OLI data at 30 m).

  While the sea-ice extent in this region of Antarctica is still far beyond (north of) the long-term median extent for November, the central pack ice is largely open and only smaller patches of high concentration sea ice and occasional very large sea-ice floes remain, north of 65° 30' S. Originating from the area north (and east) of the West Ice Shelf, a band of second year sea ice moves westward and disperses in Prydz Bay once it is past (west of) the northern tip of the fast ice surrounding iceberg D-21B.

With best regards,

Jan.

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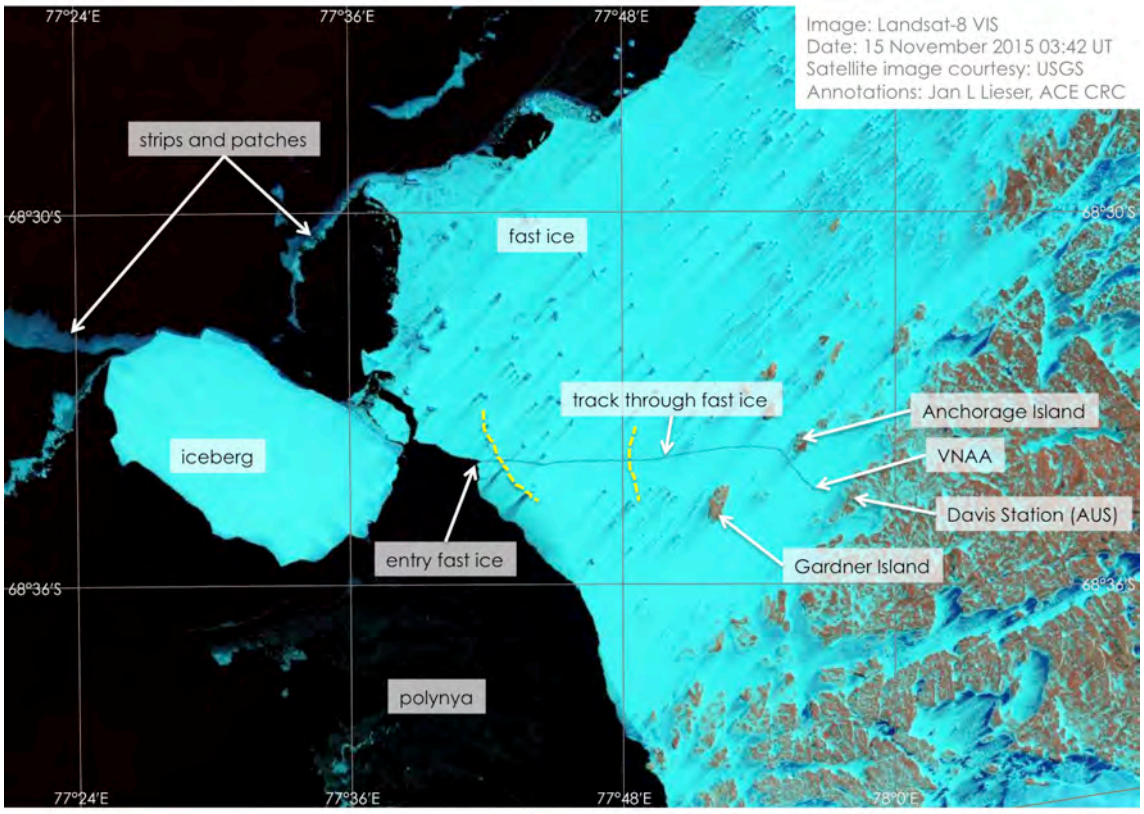

Figure 1: Landsat-8 VIS scene, acquired 15/11/2015 and provided by USGS.

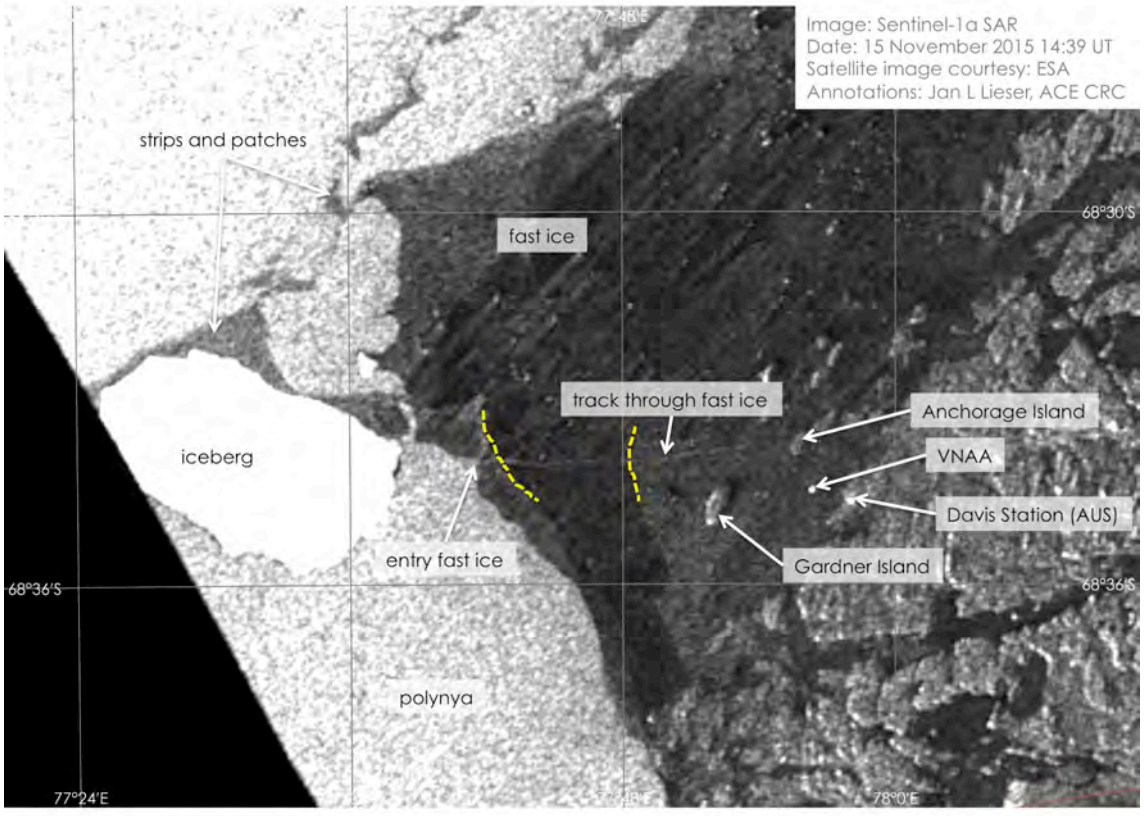

Figure 2: Sentinel-1a SAR scene, acquired 15/11/2015 and provided by ESA.

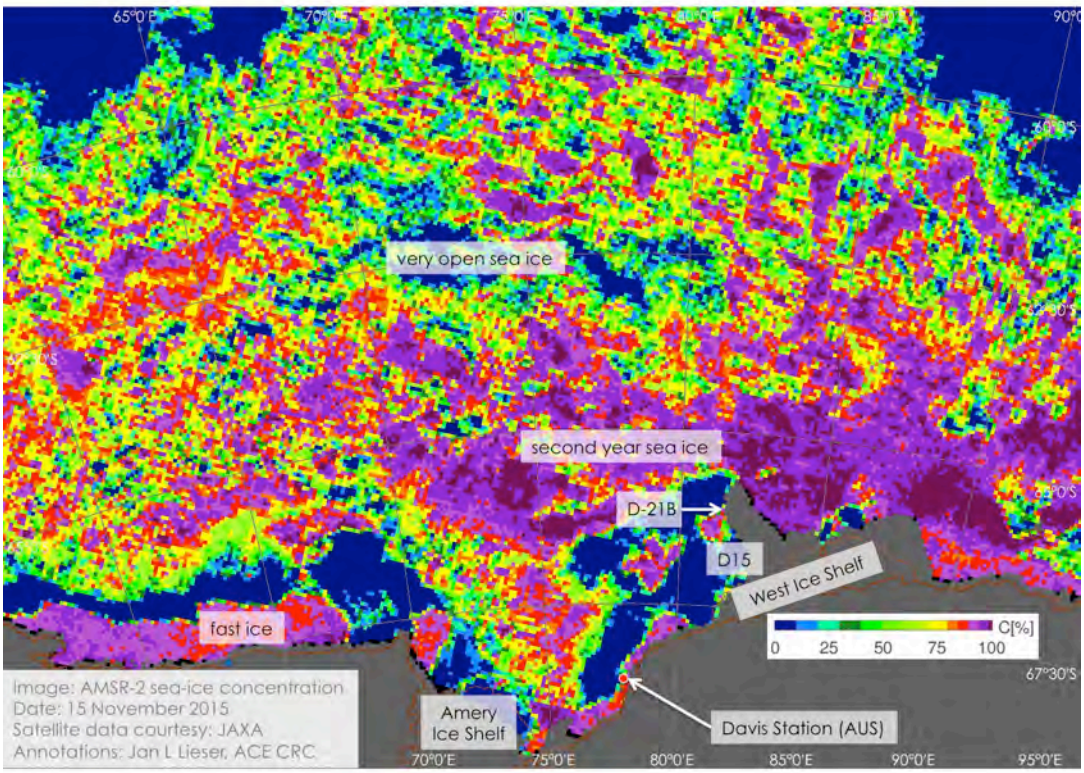

Figure 3: AMSR-2 sea-ice concentration, acquired 15/11/2015 and provided by Universiät Bremen.

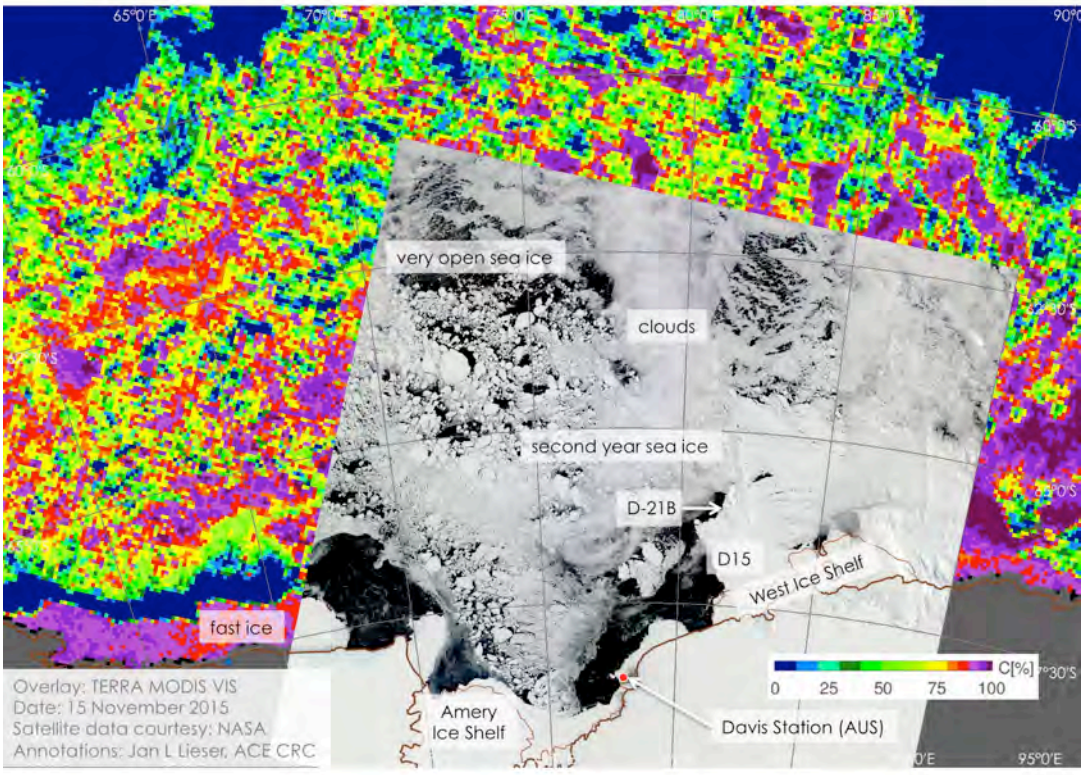

Figure 4: As for Figure 3 with overlay MODIS VIS scene, acquired 15/11/2015 and provided by NASA.

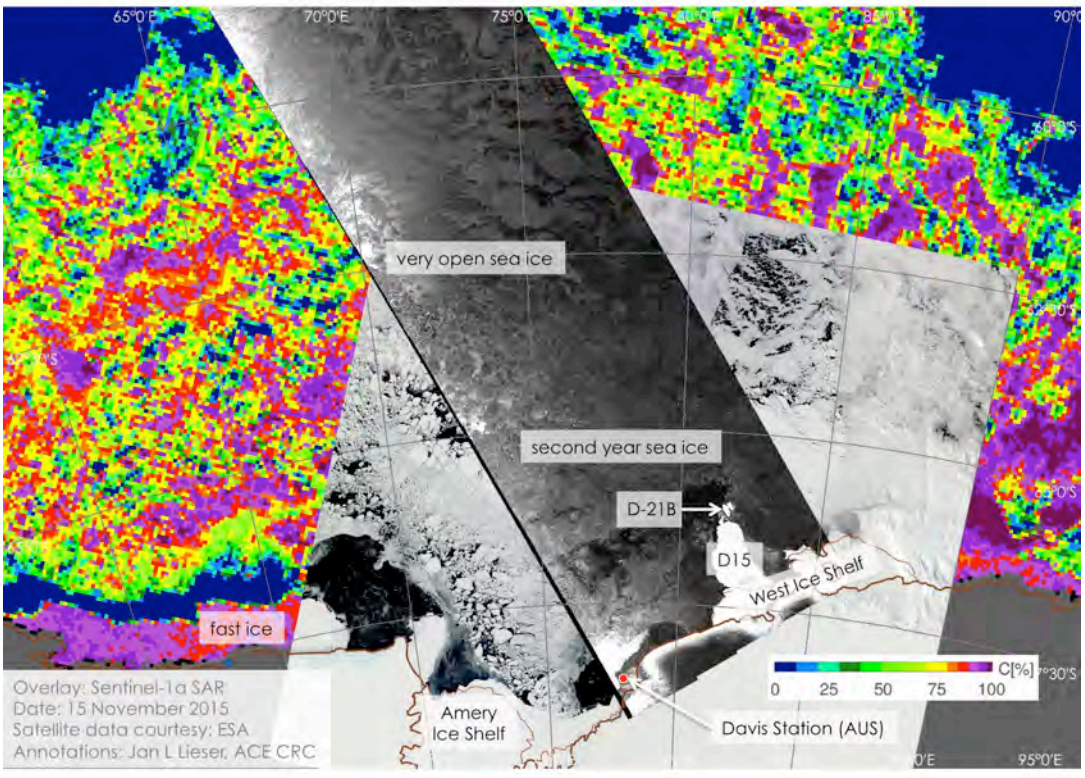

Figure 5: As for Figure 4 with overlay Sentinel-1a SAR scene, acquired 15/11/2015 and provided by PolarView.

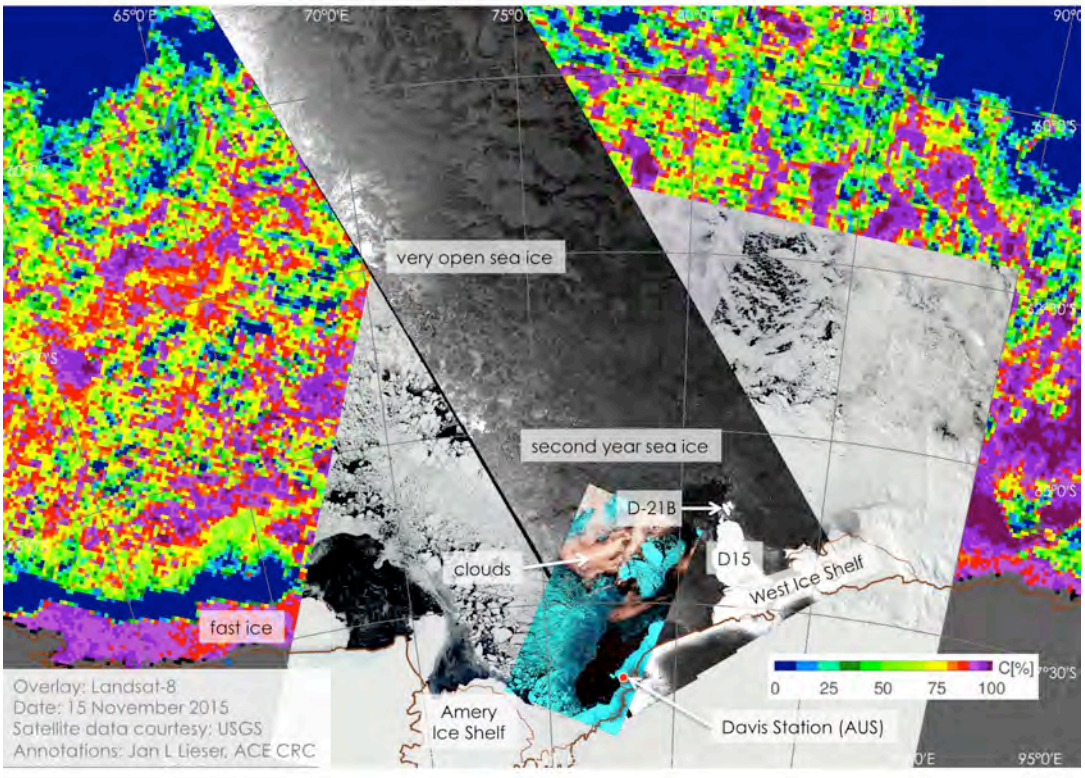

Figure 6: As for Figure 5 with overlay Landsat-8 VIS scene, acquired 15/11/2015 and provided by USGS.

Sea Ice Report #47.2/2015

by the AAD/ACE CRC Sea Ice Group*

16/11/2015

This report updates on fast-ice conditions in the vicinity of Commonwealth Bay.

- **Commonwealth Bay**
  Only the eastern part of the sea-ice zone shown in Figure 1 is slightly obscured by clouds. The continuing break-up of fast ice in the region is still recognisable, most obvious at the eastern flank of the hook-like fast ice feature between Dumont D'Urville Station and Commonwealth Bay. The fast ice edge off Commonwealth Bay remains stable at this stage, approximately 12 nautical miles north of Mawson's Huts.

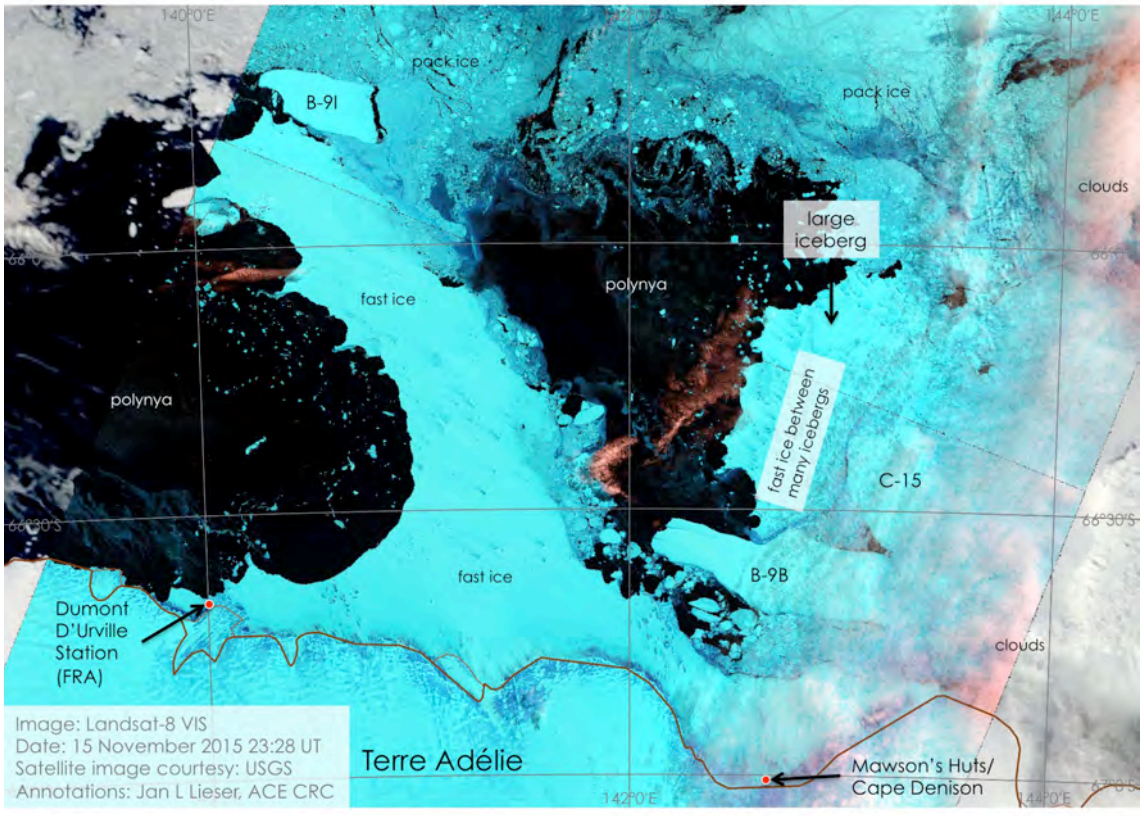

Figure 1: Operational Land Imager VIS scene, acquired 15/11/2015 and provided by USGS. Background: TERRA MODIS VIS scene, acquired 16/11/2015 and provided by NASA.

Since 11/11/15, iceberg B-9I has moved further northwestwards (roughly 18 nautical miles) and B-9B has rotated slightly clockwise.

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Figure 2 provides a close-up of Figure 1, zoomed in on Dumont D'Urville Station. At full resolution, the rocks of Île des Pétrels, archipelago of Pointe Géologie are visible and the front of the Astrolabe Glacier. The distance between the station and the fast ice edge in the north is approximately 1 nautical mile.

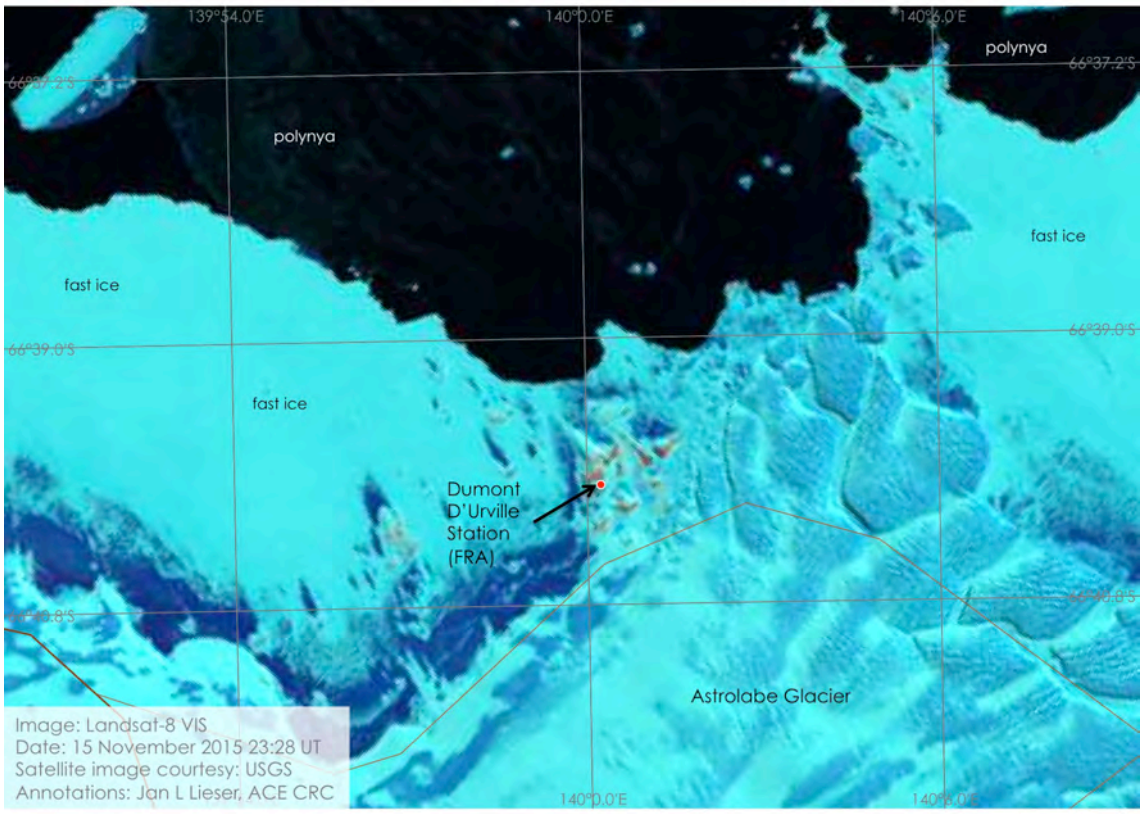

Figure 2: Operational Land Imager VIS scene, acquired 15/11/2015 and provided by USGS.

With best regards,

Jan.

Sea Ice Report #47.3/2015

by the AAD/ACE CRC Sea Ice Group*

18/11/2015

- **Davis Station**
  The scene shown in Figure 1 is only slightly obscured by clouds in the northern part of the image. The orange line denotes the cruise track of RSV *Aurora Australis* in the area; the vessel has departed Davis Station last night.

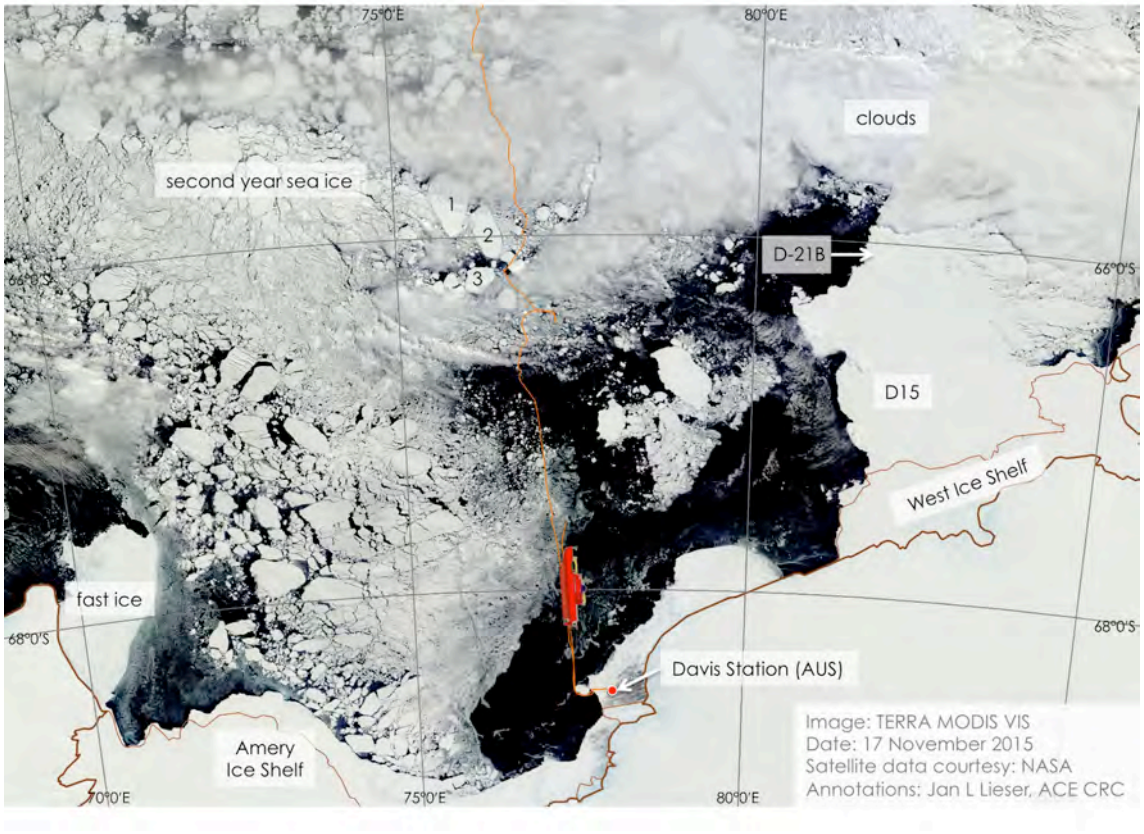

Figure 1: MODIS VIS scene, acquired 17/11/2015 and provided by NASA.

North of Davis Station, sea-ice conditions appear to have eased a little, during the past week. The general drift of the second year sea ice is northwestward and dispersing. Very large sea-ice floes (annotated '1', '2' and '3') have been tracked travelling up 45 nautical miles with only minimal rotational movement, since 10/11/2015. Sea-ice floe '3' is the one that forced the little hook feature of the cruise track (at roughly 77° S and 66° 30' S), during RSV *Aurora Australis*' southbound journey.

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North of about 64° 30' S the sea ice pack is very open (see Figure 2).

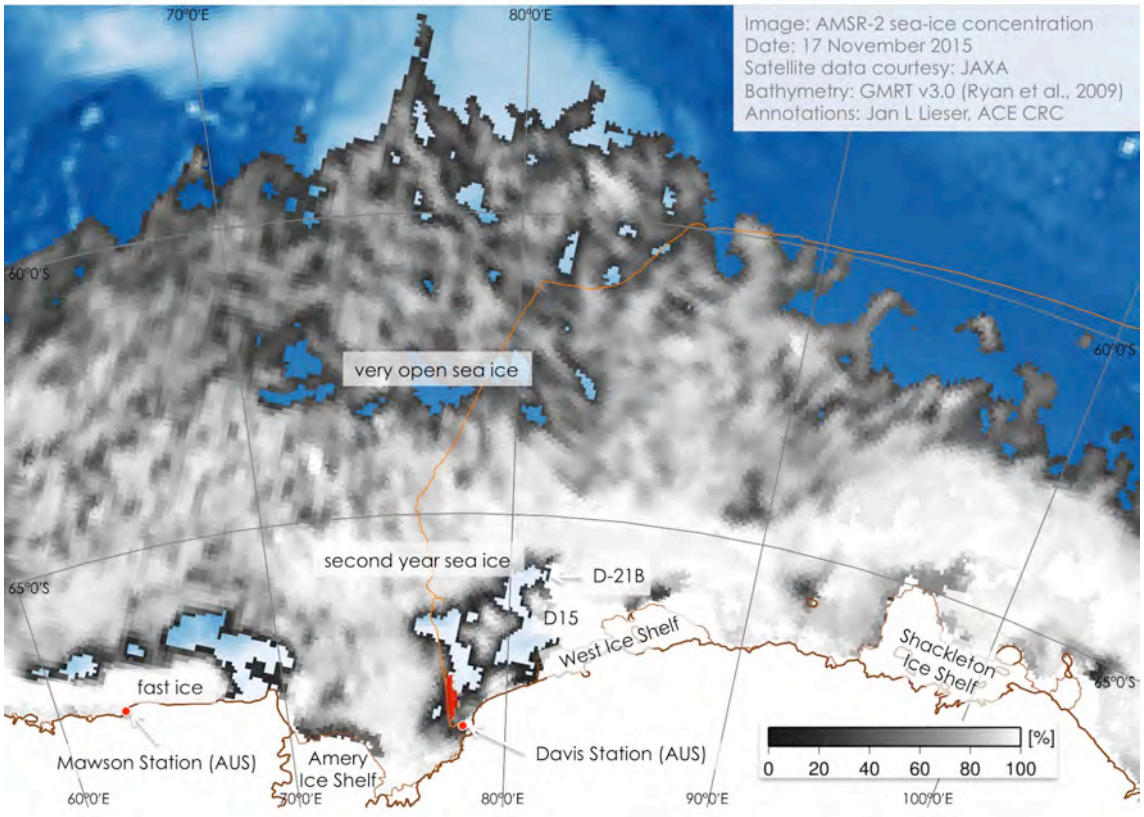

Figure 2: AMSR-2 sea-ice concentration, acquired 17/11/2015 and provided by Drift & Noise Polar Services.

With best regards,

Jan.

Sea Ice Report #47.4/2015

by the AAD/ACE CRC Sea Ice Group*

18/11/2015

This report examines sea-ice conditions with respect to planned mooring recoveries and deployments for RSV *Aurora Australis*' upcoming voyages.

- **Davis Station**
  The location of a 'recover only' whale mooring north of Davis Station is show by the red dot in Figure 1. The orange line denotes the cruise track of RSV *Aurora Australis* (up to 18/11/2015 04:00 UT) in the area.

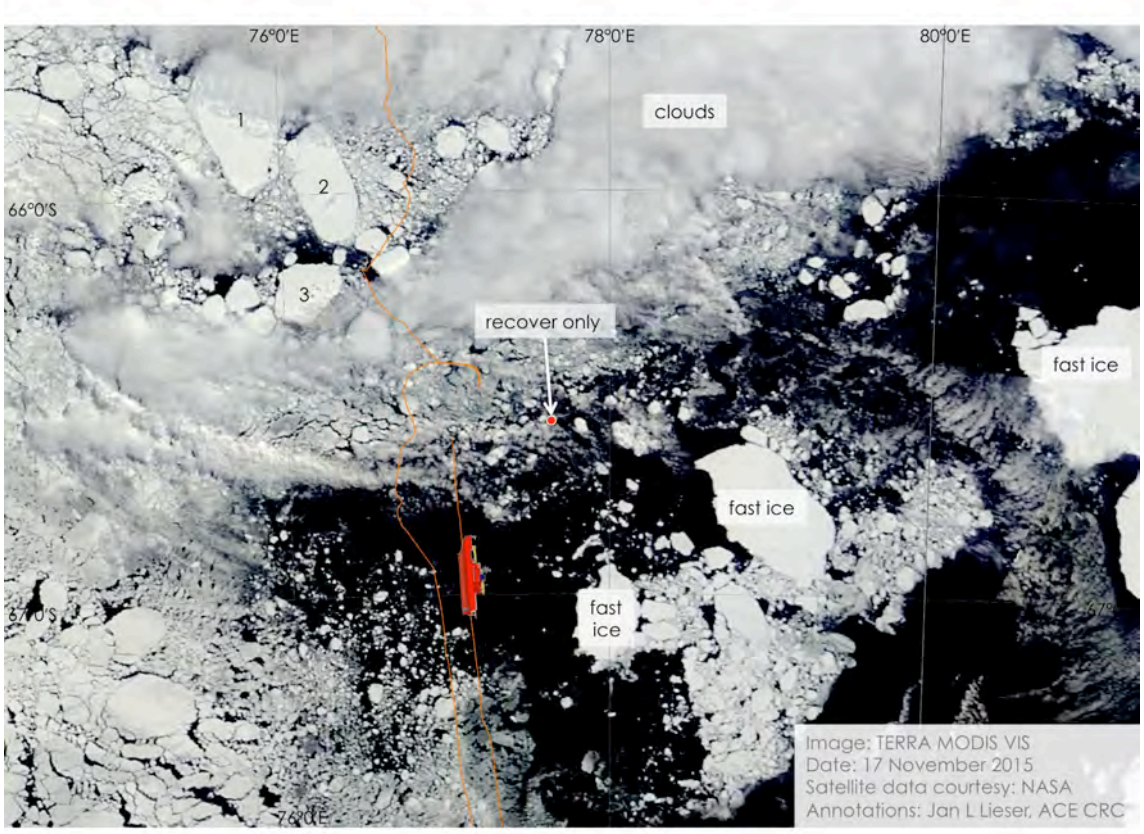

Figure 1: MODIS VIS scene, acquired 17/11/2015 and provided by NASA.

The site of this mooring is at the edge of a loose pack-ice field that is slowly drifting westward under the current conditions. To the south and southeast of the mooring, two isolated fast ice patches remain. These patches are disintegrating under summer conditions and loose sea-ice fields can be seen in the surrounds. The fast ice in the far east is still attached to icebergs D-15 and D-21B, and two more large

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tabular icebergs trapped in the region. (For annotated sea-ice floes '1', '2' and '3' see Sea Ice Report #47.3/2015).

- **East Antarctica**
  Figure 2 provides an overview of three whale mooring sites (red dots with black outline). One site north of Davis Station is to be recovered only ('R', see above paragraph) and two more sites are for recovery and deployment ('R&D'). These two sites are currently in the marginal ice zone, but north of the median sea-ice extent for December (black line in Figure 2).

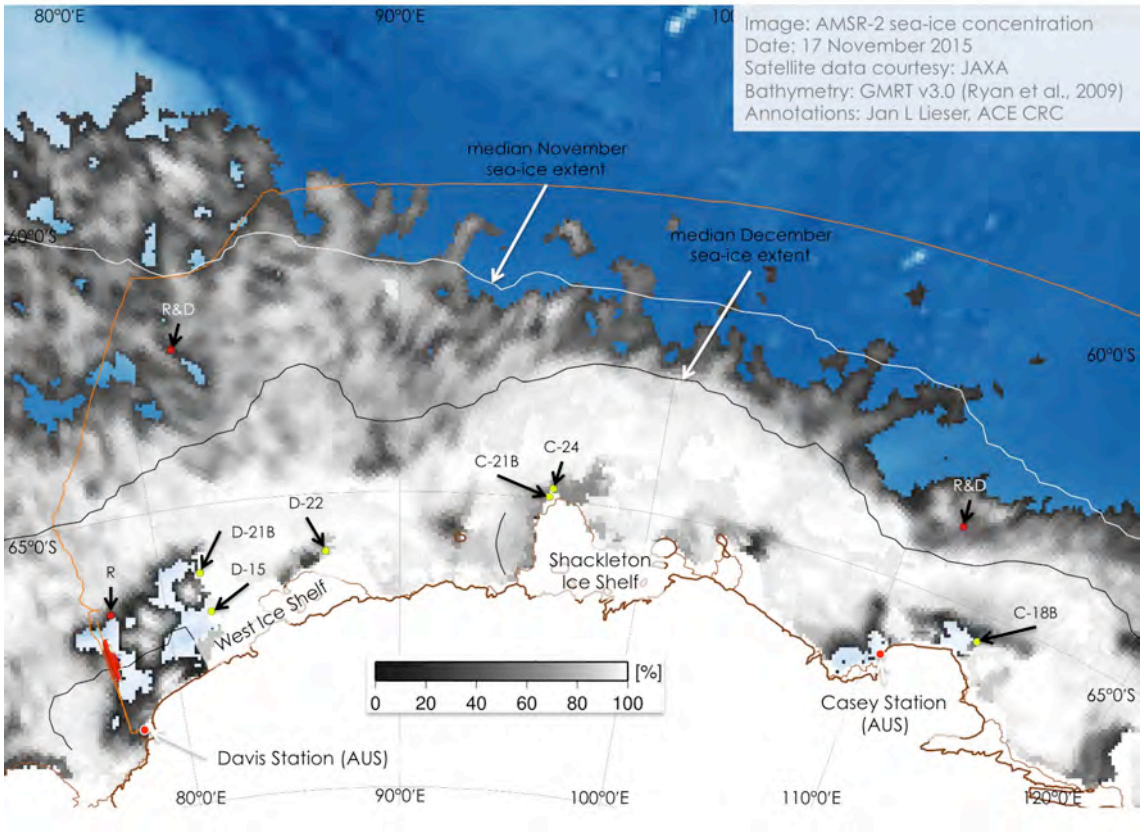

Figure 2: AMSR-2 sea-ice concentration, acquired 17/11/2015 and provided by Drift & Noise Polar Services.

Also shown in Figure 2 are the locations of large, tabular icebergs and the median sea-ice extent for November (white line).

With best regards,

Jan.

Sea Ice Report #47.5/2015

by the AAD/ACE CRC Sea Ice Group*

19/11/2015

The Bureau of Meteorology reports a strong El Niño event continuing in the tropical Pacific Ocean and a warm central and southern Indian Ocean. Both these climate parameters appear to play a significant role close to Antarctica as well.

- **Davis Station**
  In Prydz Bay, we observe decaying and dispersing sea ice, particularly north of 64° S where medium high sea-ice concentration (50 % to 60 %) dominates, see Figure 1. The figure also shows the cruise track of RSV *Aurora Australis* as an orange line (up to 19/11/2015 00:00 UT) and the locations of two moorings of interest are indicated by red dots (see Sea Ice Report #47.4/2015).

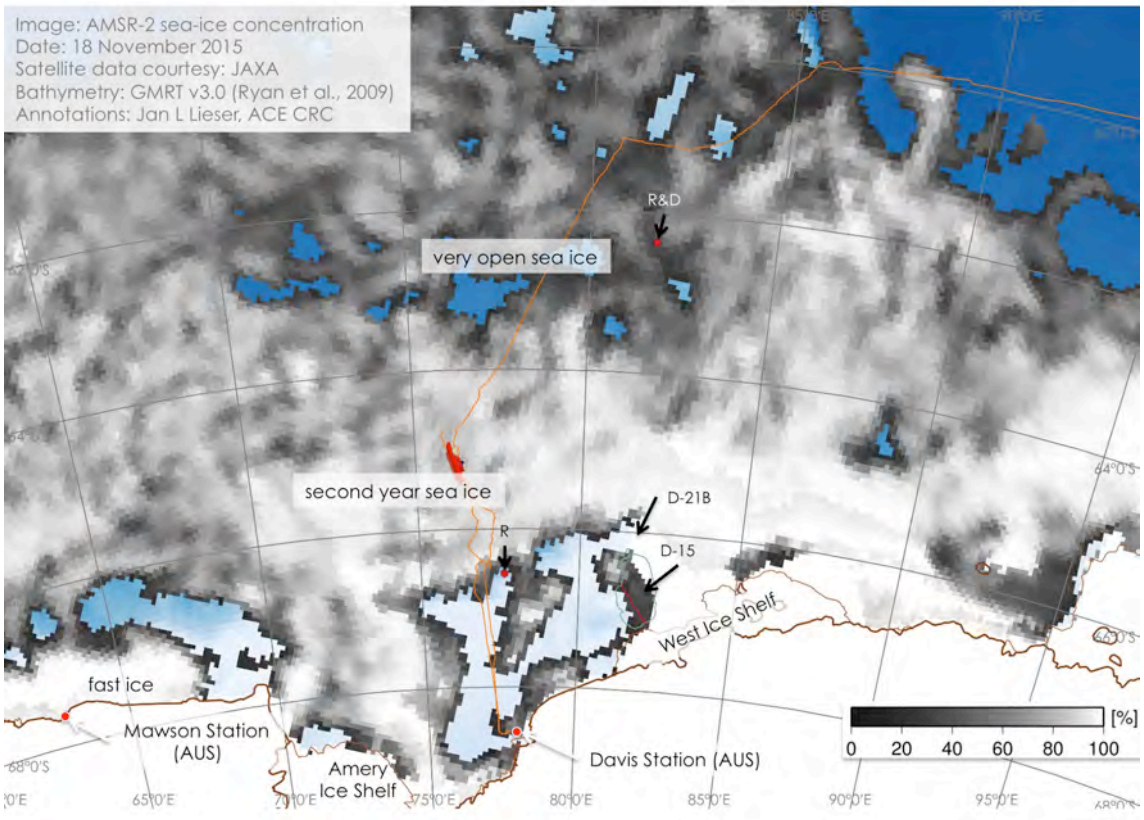

Figure 1: AMSR-2 sea-ice concentration, acquired 18/11/2015 and provided by Drift & Noise Polar Services.

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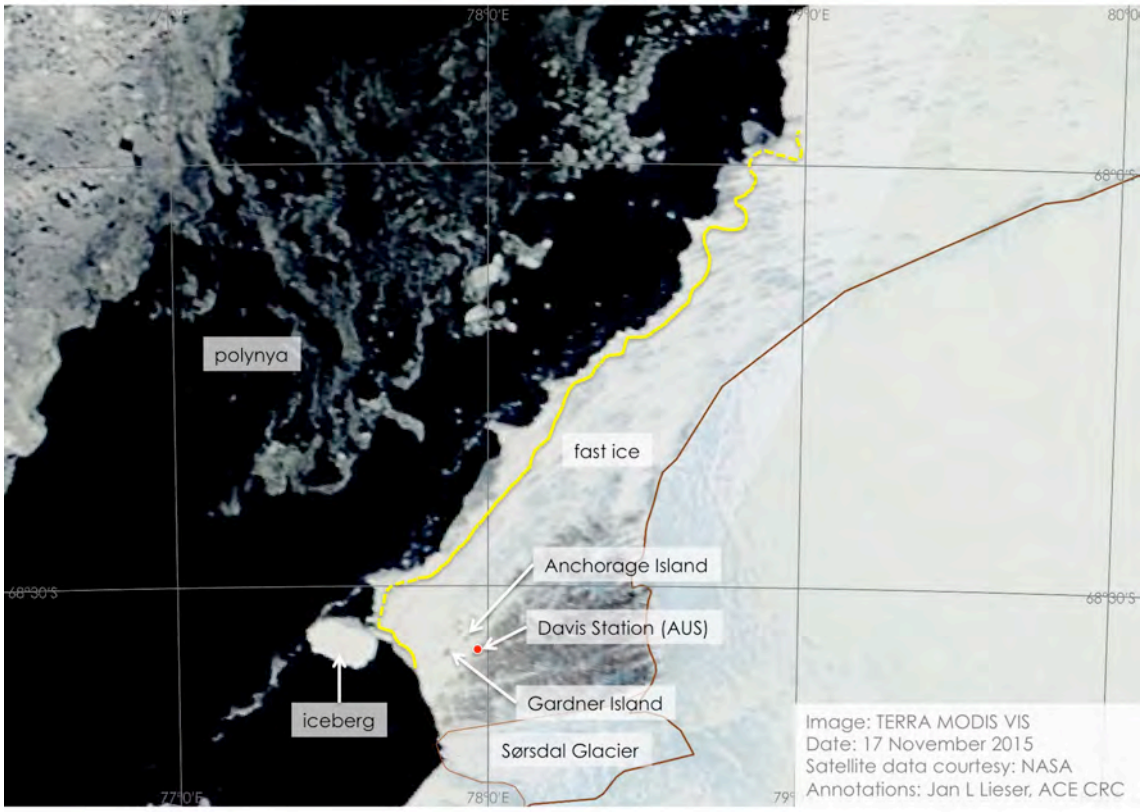

Figure 2: MODIS VIS scene, acquired 17/11/2015 and provided by NASA.

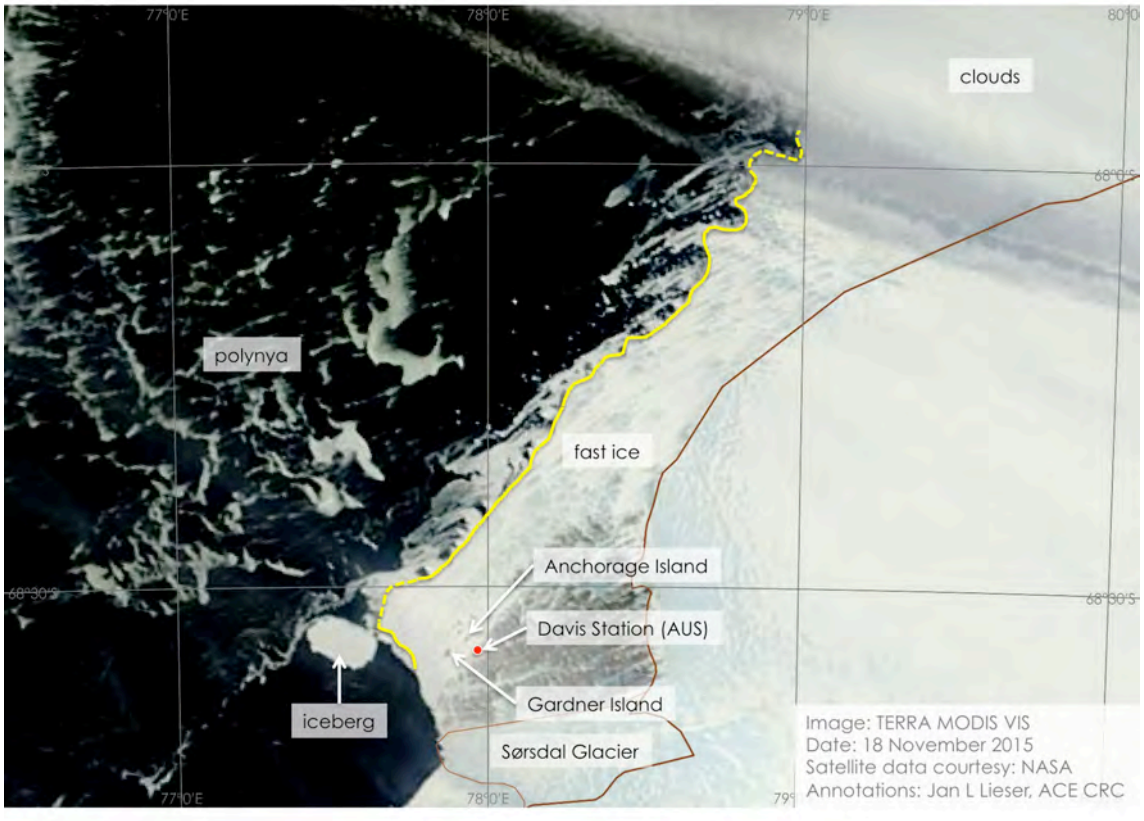

Figure 3: MODIS VIS scene, acquired 18/11/2015 and provided by NASA.

The edge of the fast ice offshore and north of Davis Station is retreating towards the coast. Over night, 3 nautical miles to 4 nautical miles have broken off. The new fast ice edge is indicated by the yellow line in Figures 2 and 3.

With best regards,

Jan.

Sea Ice Report #47.x/2015

by the AAD/ACE CRC Sea Ice Group*

19/11/2015

- **Ross Sea**
  Figure 1 shows the sea-ice concentration anomaly (relative to the 1992-2001 average) around Antarctica, in October 2015. The average sea-ice extent (for the same period) is given by the black line. Sea ice in the Ross Sea was close to average in western Ross Sea, during October 2015, but below average in the eastern part of the Ross Sea, towards Amundsen Sea. The strong and well established El Niño event in the tropical Pacific Ocean is expected to be linked with this distribution.

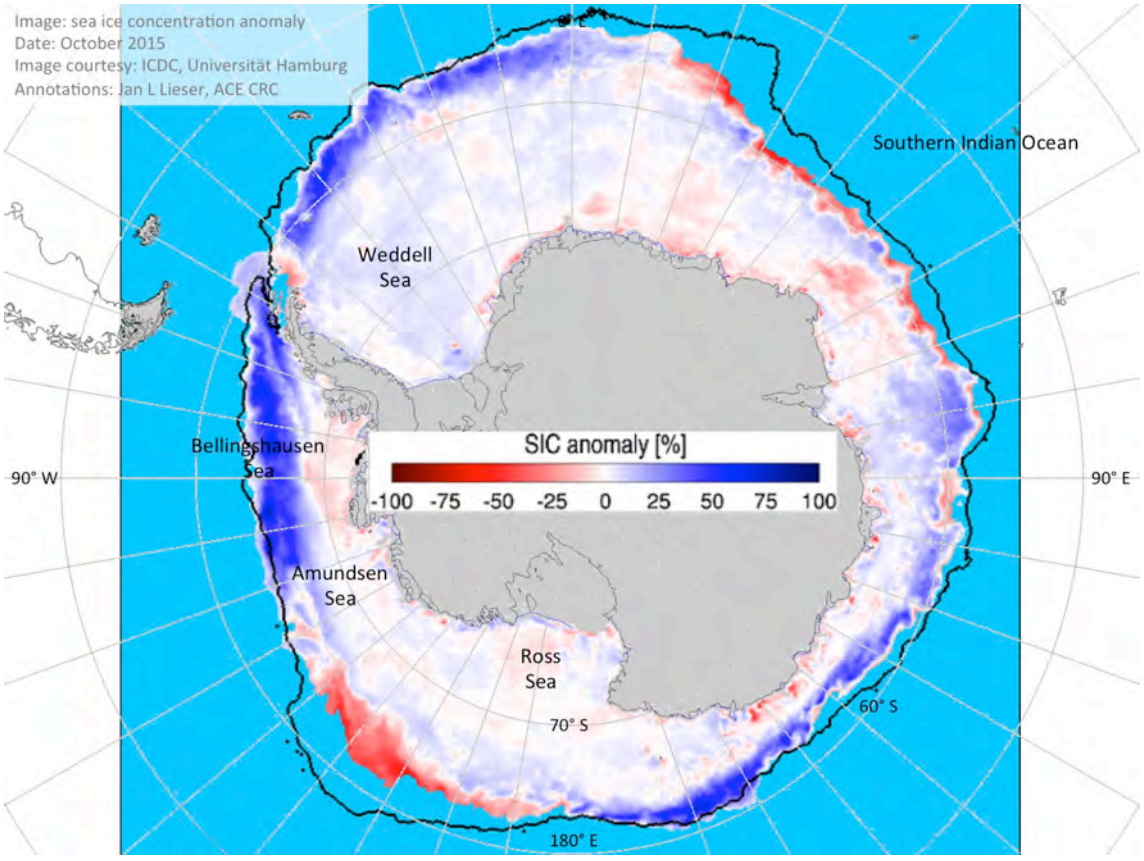

Figure 1: Sea-ice concentration anomaly, provided by Universität Hamburg.

Yesterday's sea-ice concentration is given in Figure 2 as a backdrop for a collection of Synthetic Aperture Radar data. The northernmost

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SAR swath was collected on 12/11/2015, the next one to the south was collected on 13/11/2015, and the southern two swaths were collected on 14/11/2015 (the holes/circles of missing data along the date-line are a processing artefact). Also shown in the figure are the long-term (1981-2010) median sea-ice extent for November (blue line) and December (magenta line).

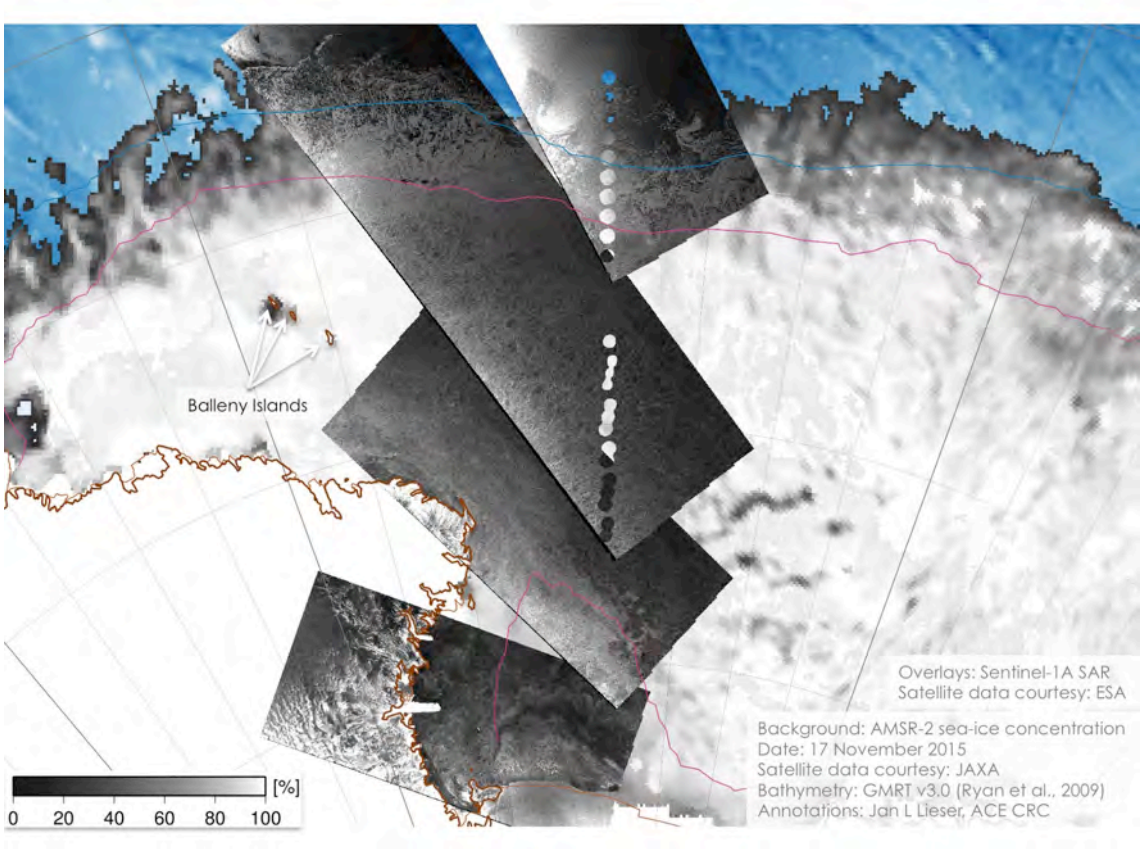

Figure 2: Sentinel-1a SAR scenes, acquired 12 and 13 and 14/11/2015 and provided by PolarView. Background: AMSR-2 sea-ice concentration, acquired 17/11/2015 and provided by Drift & Noise Polar Services.

The central Ross Sea is currently still dominated by high concentration first year sea ice. Only a small (in north-south direction) band of old sea ice is present at roughly 66° S.

With best regards,

Jan.

Sea Ice Report #47.6/2015

by the AAD/ACE CRC Sea Ice Group*

20/11/2015

This reports considers sea-ice condition north of Casey Station.

- **Casey Station**
  Figure 1 shows a close-up detail of the SAR scene of Figure 2. A curious feature to note in this image is the ripple structure at the northern end of the area of high-concentration sea ice (yellow ellipse), showing waves in sea ice. Also annotated is a selection of small icebergs drifting freely in the pack ice.

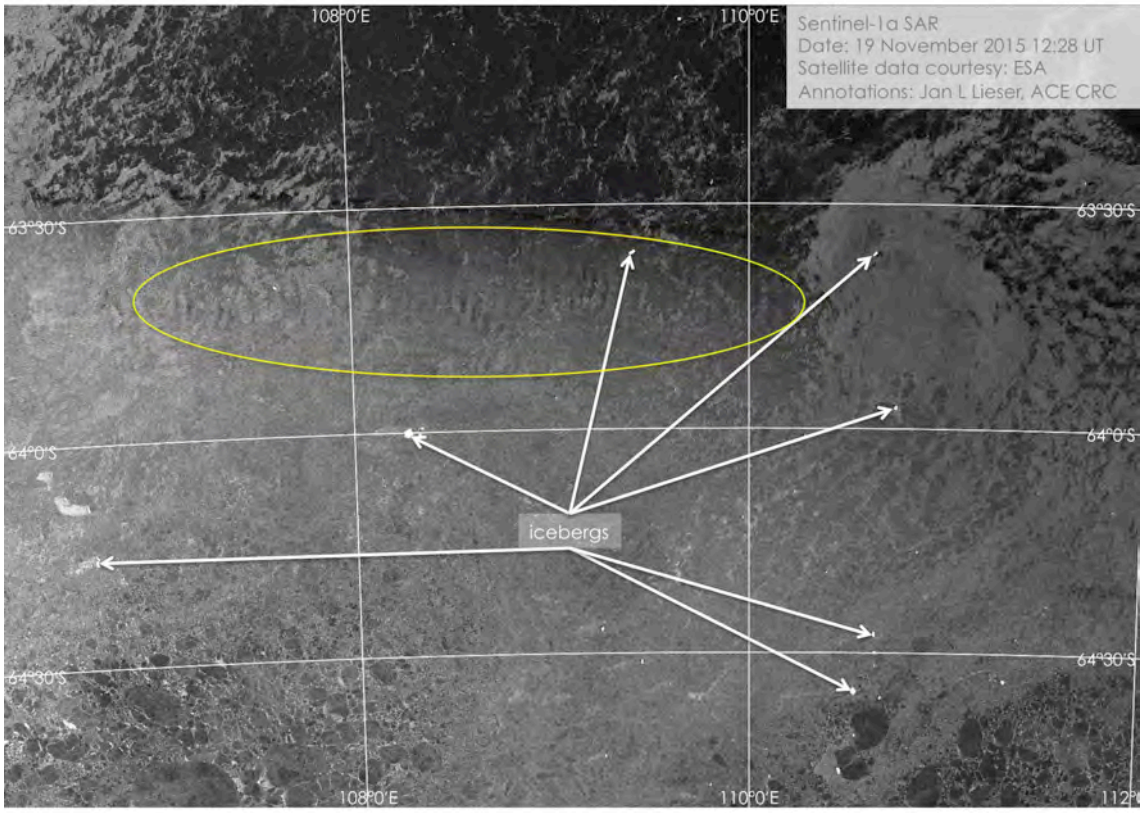

Figure 1: Sentinel-1a SAR scene, acquired 19/11/2015 and provided by PolarView.

This detail does not stand out so clearly in the overview of Figure 2, but the very low concentration of sea ice (<15%) remains evidently visible as stripes and patches, north of the ripples. Additionally, the long-term median sea-ice extent for November and December is given by the blue and green line, respectively, in Figures 2 and 3.

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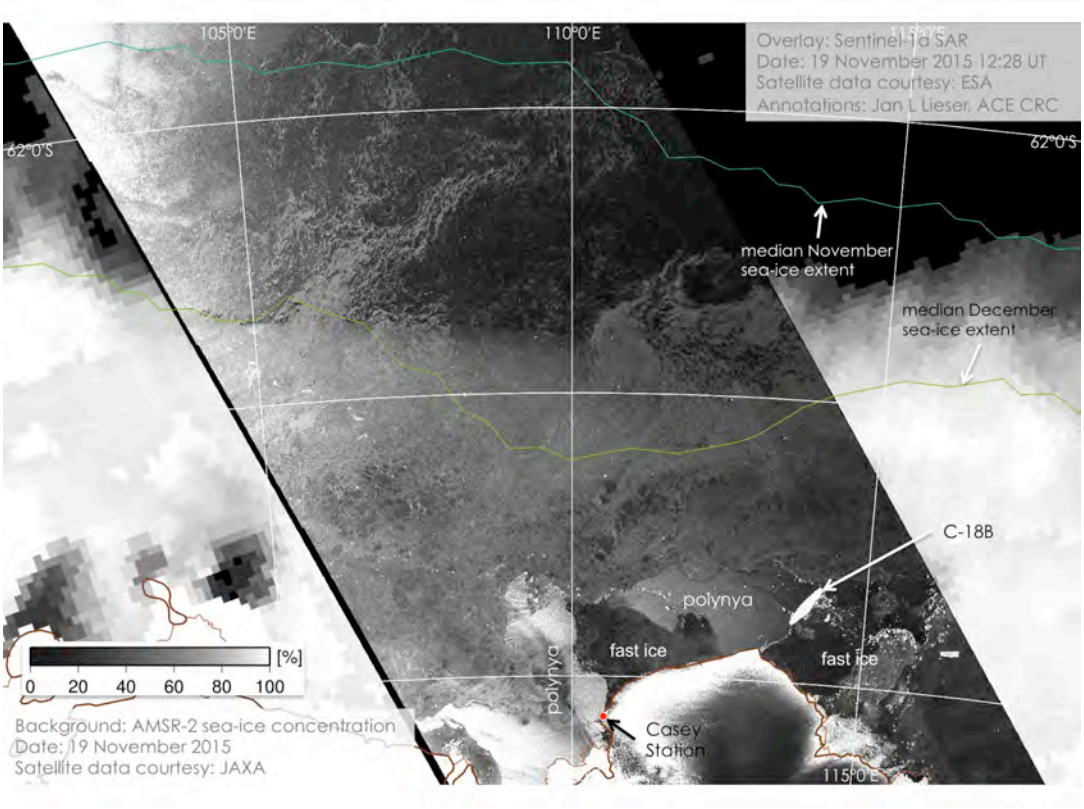

Figure 2: Sentinel-1a SAR scene, acquired 19/11/2015 and provided by PolarView. Background: AMSR-2 sea-ice concentration, acquired 19/11/2015 and provided by Drift & Noise Polar Services.

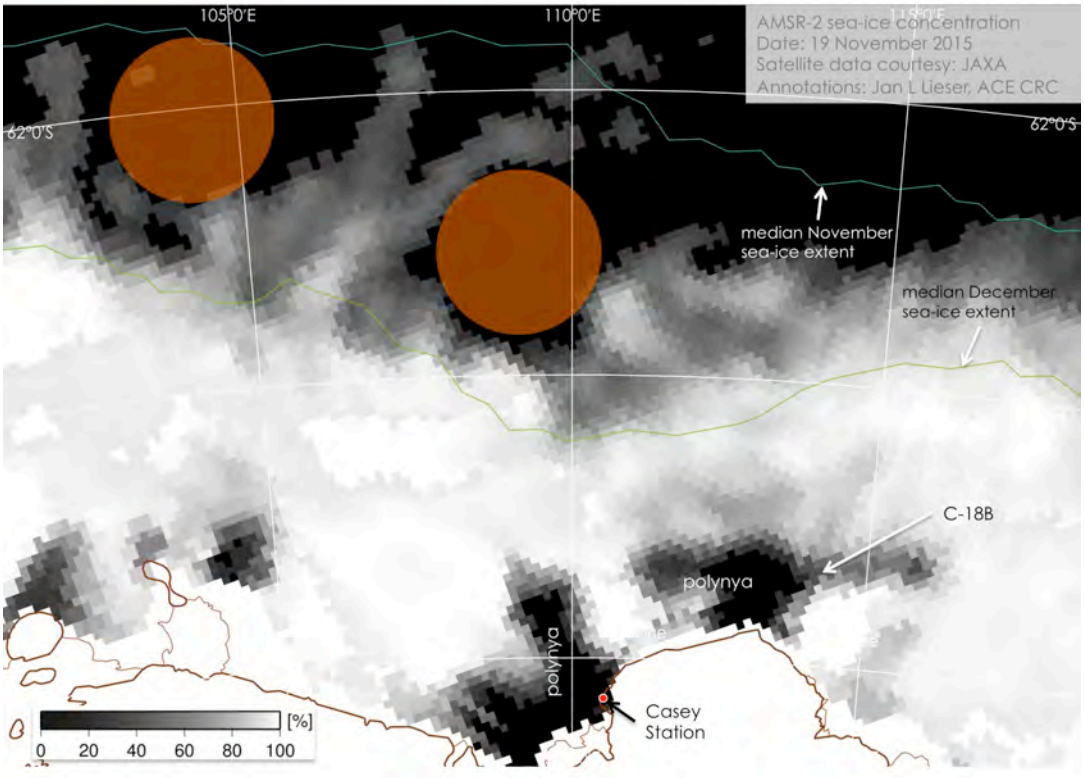

Figure 3: AMSR-2 sea-ice concentration, acquired 19/11/2015 and provided by Drift & Noise Polar Services.

The marginal ice zone is currently very wide (north-south extent), roughly 200 nautical miles along 109° E. However, the high concentration sea ice is close to the long-term December median extent, west of 106° 30' E, and between the November and December median east of 106° 30' E.

Figure 3 provides comparison with the sea-ice concentration product, which indicates open water in regions where there is in fact a high concentration of strips and patches (orange shaded shapes), which are undetected by the algorithms that compute sea-ice concentration.

With best regards,

Jan.

Sea Ice Report #47.7/2015

by the AAD/ACE CRC Sea Ice Group*

20/11/2015

- **Ross Sea**
  Figure 1 shows yesterday's sea-ice concentration chart with an overlay of high-resolution synthetic aperture RADAR data, also acquired on 19/11/2015.

  The dashed orange line shows a boundary south of which some sea ice can reasonably be expected. The red dashed line indicates roughly the transition from the marginal ice zone north of it to the high concentration pack ice zone in the south. During the past week, this boundary has moved about 75 nautical miles southward, west of 180° E, but remained more or less stationary east of 180° E.

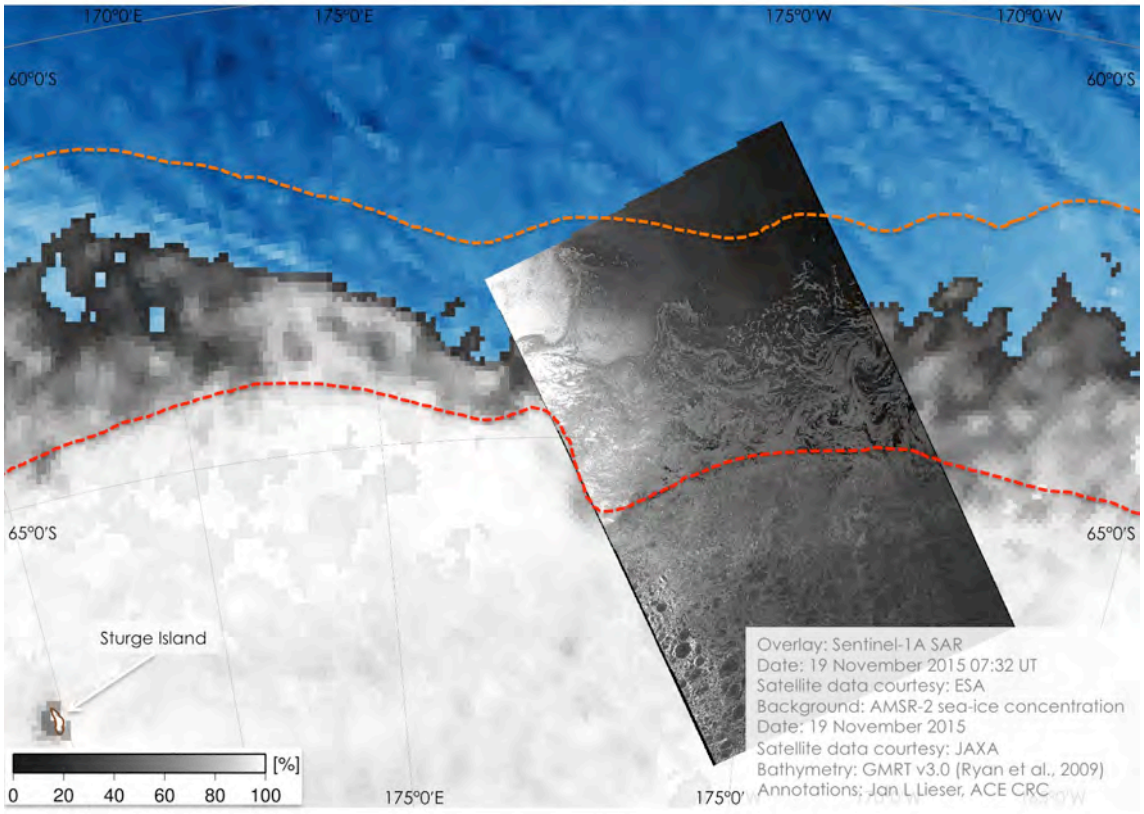

Figure 1: AMSR-2 sea-ice concentration, acquired 19/11/2015 and provided by Drift & Noise Polar Services. Overlay: Sentinel-1a SAR scene, acquired 19/11/2015 and provided by PolarView.

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The sea-ice edge exhibits currently many strips and patches stretching northward like filigree structures consisting of very small floes and brash ice. This is evident from the high-resolution SAR data. Those structures are highly mobile and are visible manifestations of oceanic eddy structures in the region.

With best regards,

Jan.

Sea Ice Report #48.1/2015

by the AAD/ACE CRC Sea Ice Group*

23/11/2015

This report updates on fast-ice conditions off Mawson Station.

- **Mawson Station**
  The fast-ice edge off Mawson Station is showing signs of retreat. Figure 1 shows a MODIS visible image of the fast ice, with a red scribble line indicating the location of the edge on 17/11/2015. Yesterday, from the polynya bay northwest of the station to 'iceberg alley', the fast-ice edge was between 1 nautical mile and 3 nautical miles closer to the continent and this trend continues further east.

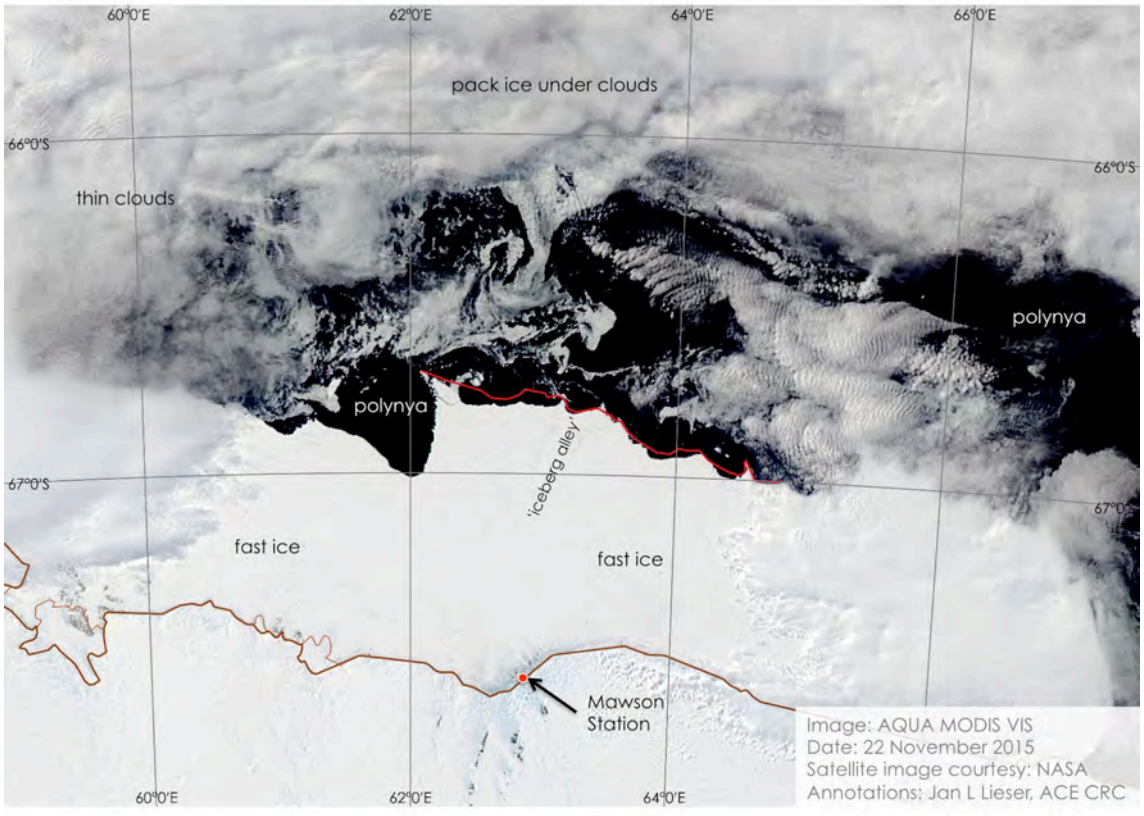

Figure 1: MODIS VIS scene, acquired 22/11/2015 and provided by NASA.

The synthetic aperture Radar image of Figure 2 allows for a more detailed analysis of the fast ice between the coastal polynya and Mawson Station. Different types of surface roughness (represented in shades of grey) are seen especially west of the station, an area which appears uniformly white in the visible image (Figure 1). Those

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characteristics are likely related to the age and formation process of the fast ice (and its snow cover). Between 'iceberg alley' and Mawson Station, the fast ice appears to be quite homogeneous.

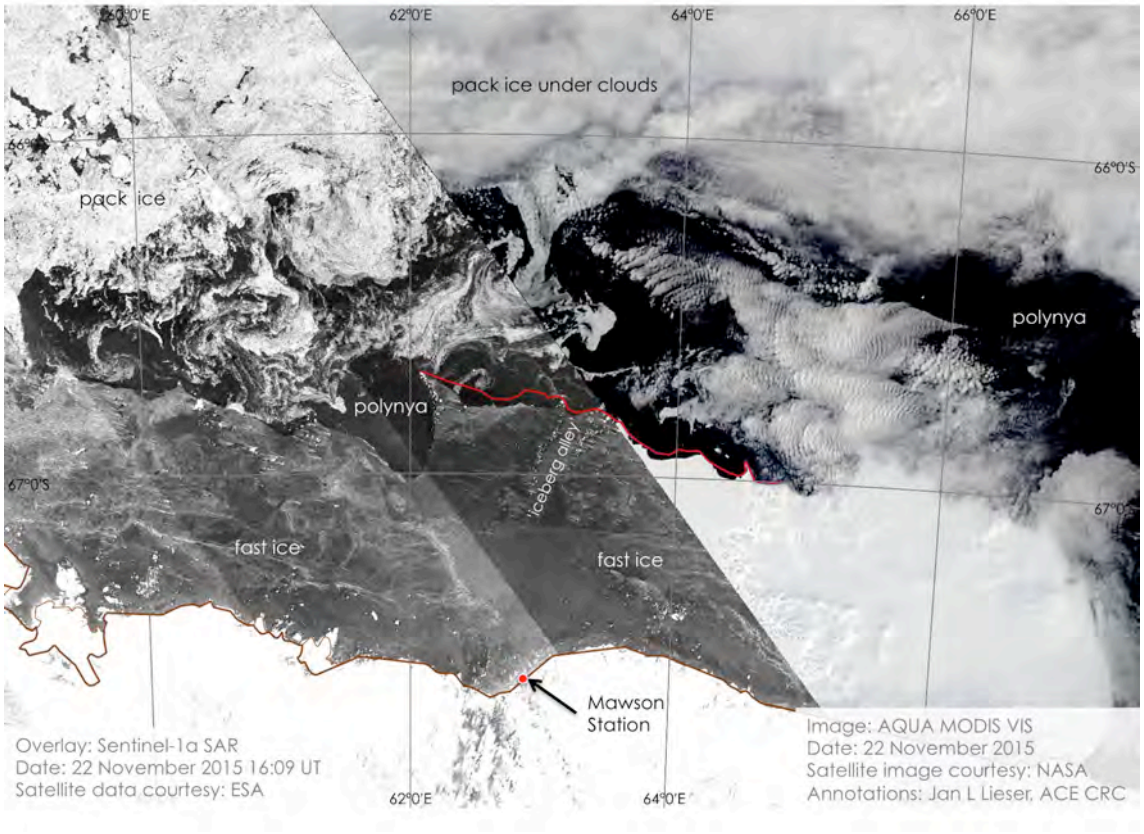

Figure 2: Sentinel-1a SAR scene, acquired 22/11/2015 and provided by PolarView.

With best regards,

Jan.

Sea Ice Report #48.2/2015

by the AAD/ACE CRC Sea Ice Group*

23/11/2015

This report updates on fast-ice conditions off Davis Station.

- **Davis Station**
  As indicated in Sea Ice Report #48.1/2015, the fast ice is retreating also in eastern Prydz Bay, offshore Davis Station and to the northeast of it. Even though most of the scene shown in Figure 1 is obscured by thin clouds, the fast-ice edge can be seen and a red scribble line marks the location of the edge on 17/11/2015. Currently, the fast-ice edge is between 1 nautical mile and 4 nautical miles closer to the continent, offshore Vestfold Hills, but further northeast up to 9 nautical miles closer to the continent (along 79° E).

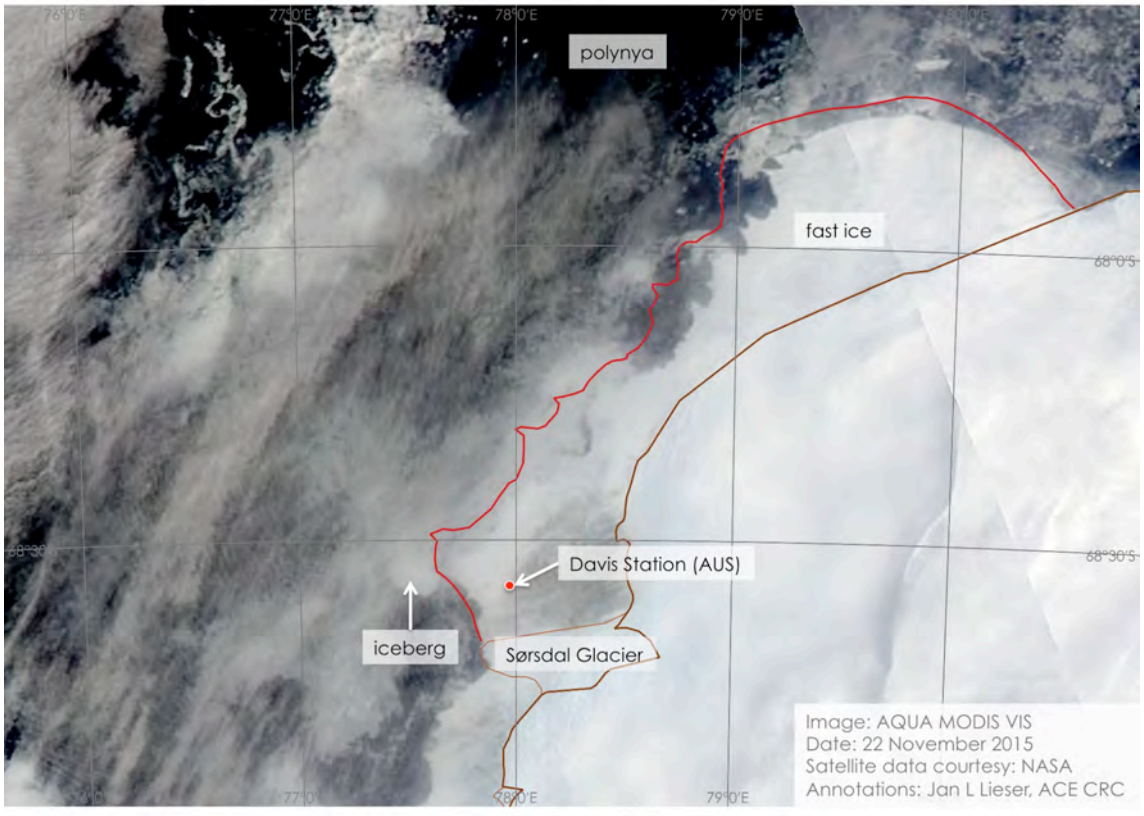

Figure 1: MODIS VIS scene, acquired 22/11/2015 and provided by NASA.

With best regards,

Jan.

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Sea Ice Report #48.3/2015

by the AAD/ACE CRC Sea Ice Group*

23/11/2015

- **Ross Sea**
  Figure 1 shows yesterday's sea-ice concentration chart with an overlay of high-resolution synthetic aperture RADAR data.

  The dashed orange line shows a boundary south of which some sea ice can reasonably be expected. The dashed red line indicates roughly the transition from the marginal ice zone north of it to the high-concentration pack-ice zone in the south. During the weekend, this boundary has reached 65° S, west of 180° E, and transitioned southward by a few degrees, east of 180° E.

  The white line in Figure 1 shows the long-term median sea-ice extent for November in the region.

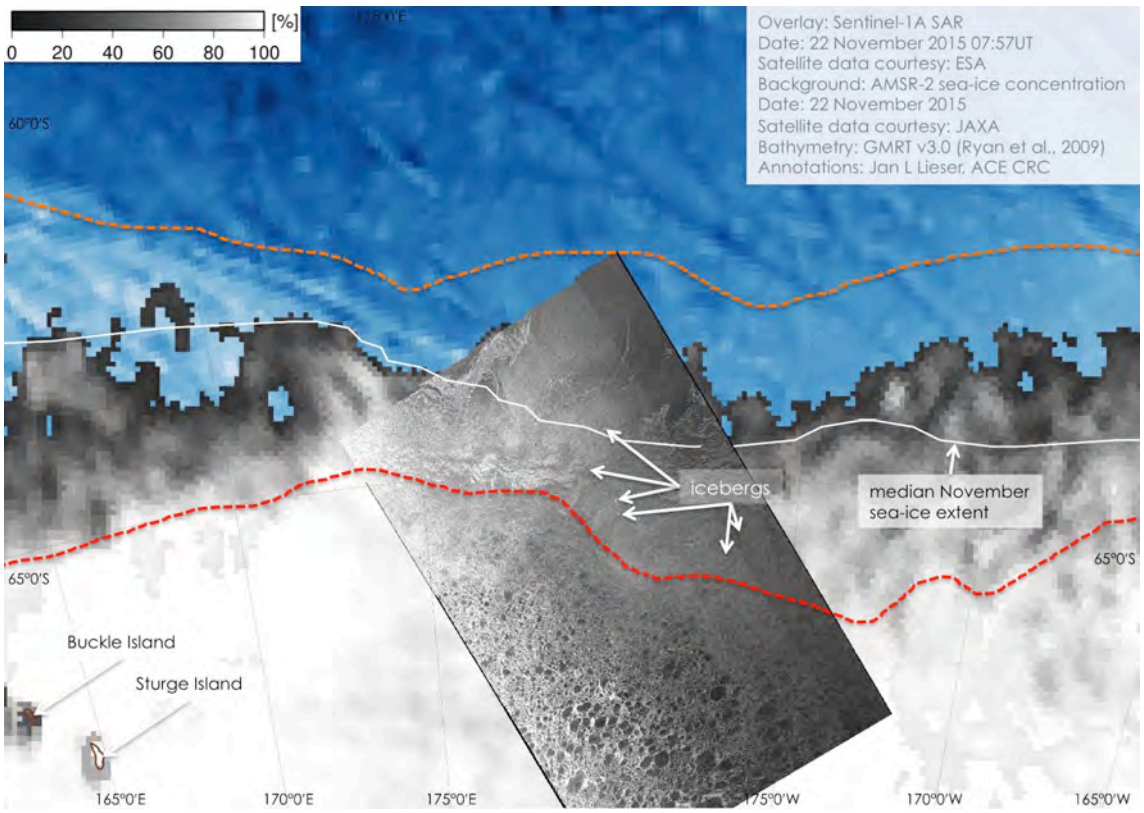

Figure 1: AMSR-2 sea-ice concentration, acquired 22/11/2015 and provided by Drift & Noise Polar Services. Overlay: Sentinel-1a SAR scene, acquired 22/11/2015 and provided by PolarView.

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While the sea-ice edge remains highly mobile and small scale oceanic eddy structures are visible with sea-ice patches in the region, the sea ice is almost entirely south of the median extent for November, west of 180° E. East of 180° E, some sea ice remains north of the long term median extent.

Some larger tabular icebergs can be identified in the SAR image; a few drifting with the marginal ice zone are annotated in the figure.

With best regards,

Jan.

Sea Ice Report #48.4/2015

by the AAD/ACE CRC Sea Ice Group*

24/11/2015

This report updates on fast-ice conditions off Zhongshan Station and sea-ice conditions in the larger Prydz Bay region.

- **Zhongshan Station**
  Figure 1 shows a Landsat-8 Operational Land Imager (OLI) visible scene of the Larsemann Hills and the offshore fast ice. The fast-ice edge off Zhongshan Station is not yet showing signs of retreat, even though fast ice off Cape Darnley in the west and off Davis Station in the north does break up. The fast-ice edge is roughly 19 nautical miles north of the Zhongshan Station. The dashed orange line in Figure 1 indicates a boundary between different types of fast ice, where the western part formed probably later than the fast ice off Dålkøy Bay.

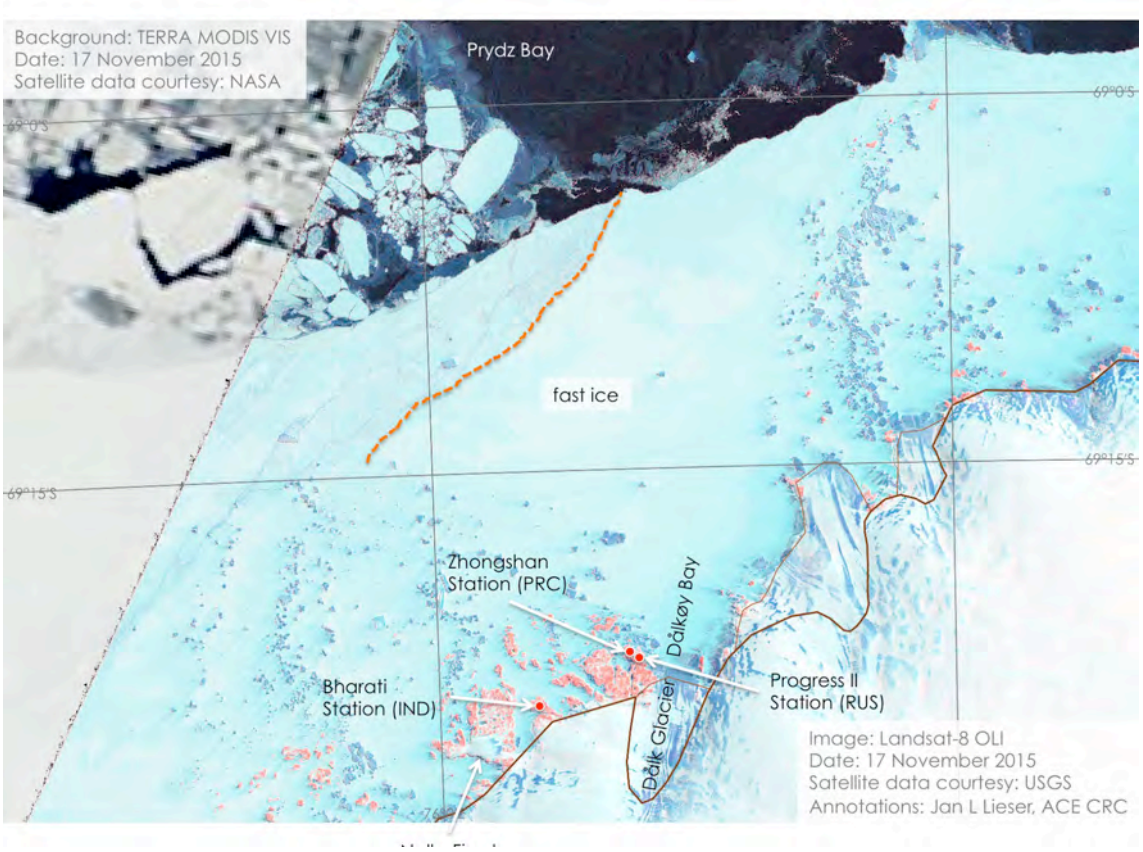

Figure 1: Landsat-8 OLI VIS scene, acquired 17/11/2015 and provided by USGS.

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An overview of sea-ice concentration is provided in Figure 2. In the central part of Prydz Bay, the marginal ice zone has progressed south and reached 64° S, between roughly 73° E and 80° E. A thinning band of old sea ice is still protruding into Prydz Bay from the east. The core of this old sea ice lies north of the West Ice Shelf with a tongue of old floes reaching to about 74° 30' E and 66° S.

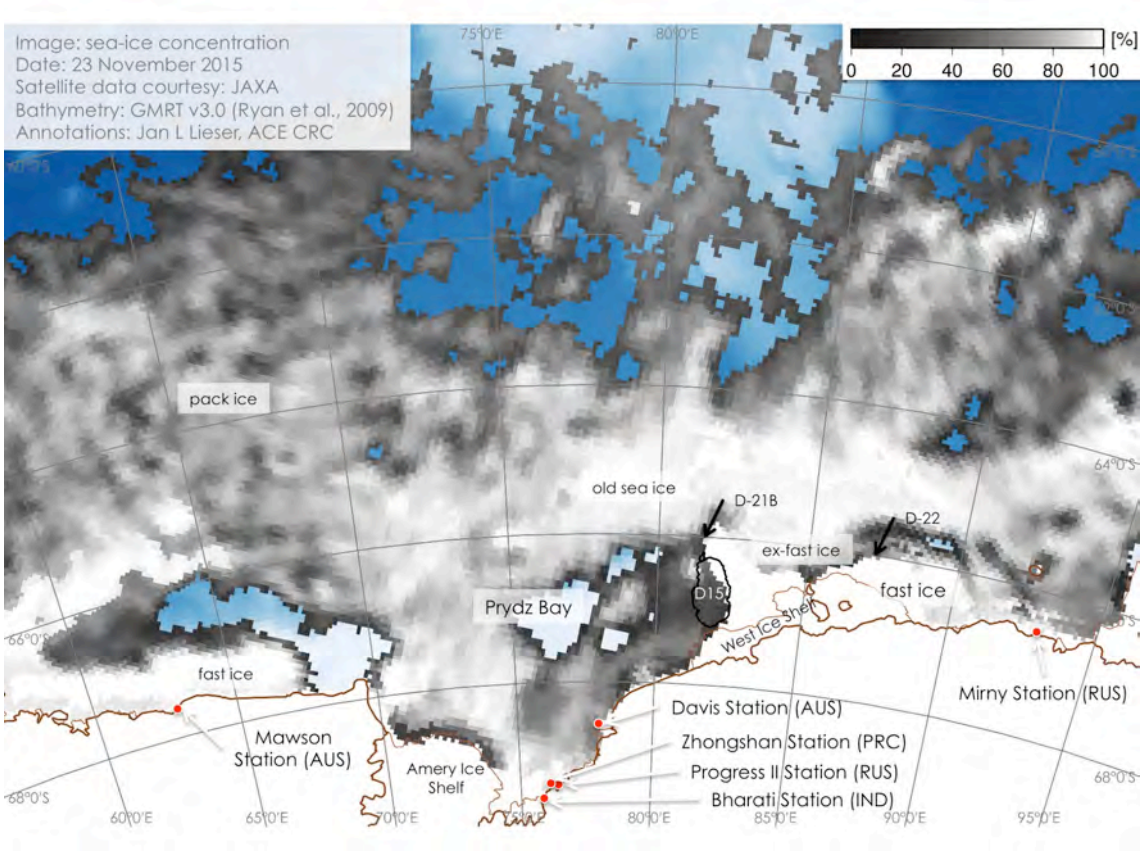

Figure 2: AMSR-2 sea-ice concentration, acquired 23/11/2015 and provided by Drift & Noise Polar Services.

With best regards,

Jan.

Sea Ice Report #48.5/2015

by the AAD/ACE CRC Sea Ice Group*

25/11/2015

- **Casey Station**
  The marginal ice zone off Law Dome and Sabrina Coast is currently relatively wide (north-south extent). The transition between the marginal ice zone and and the consolidated pack ice is indicated by the dashed orange line in Figure 1. Off Casey Station, this zone of higher concentration sea ice (south of the dashed line) is roughly 60 nautical miles wide (north-south).

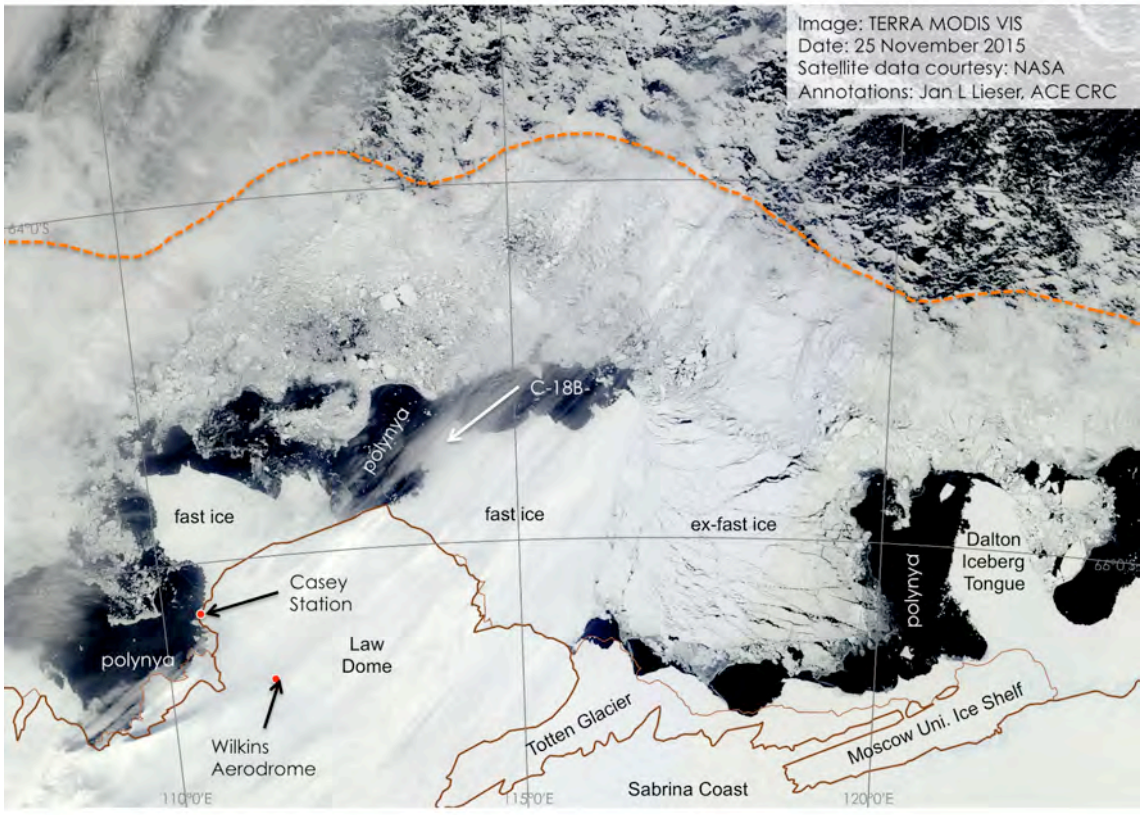

Figure 1: MODIS VIS scene, acquired 25/11/2015 and provided by NASA.

The so-called Dalton polynya (west of the Dalton Iceberg Tongue) is well established and ex-fast ice has separated from Sabrina Coast/Totten Glacier.

With best regards,

Jan.

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Sea Ice Report #48.6/2015

by the AAD/ACE CRC Sea Ice Group*

26/11/2015

- **Ross Sea**
  Figure 1 shows yesterday's sea-ice concentration chart with overlays of high-resolution synthetic aperture RADAR data.

  The dashed orange line indicates a boundary south of which some sea ice can reasonably be expected. The white and red lines in the figure show the long-term median sea-ice extent for November and December, respectively, in the region.

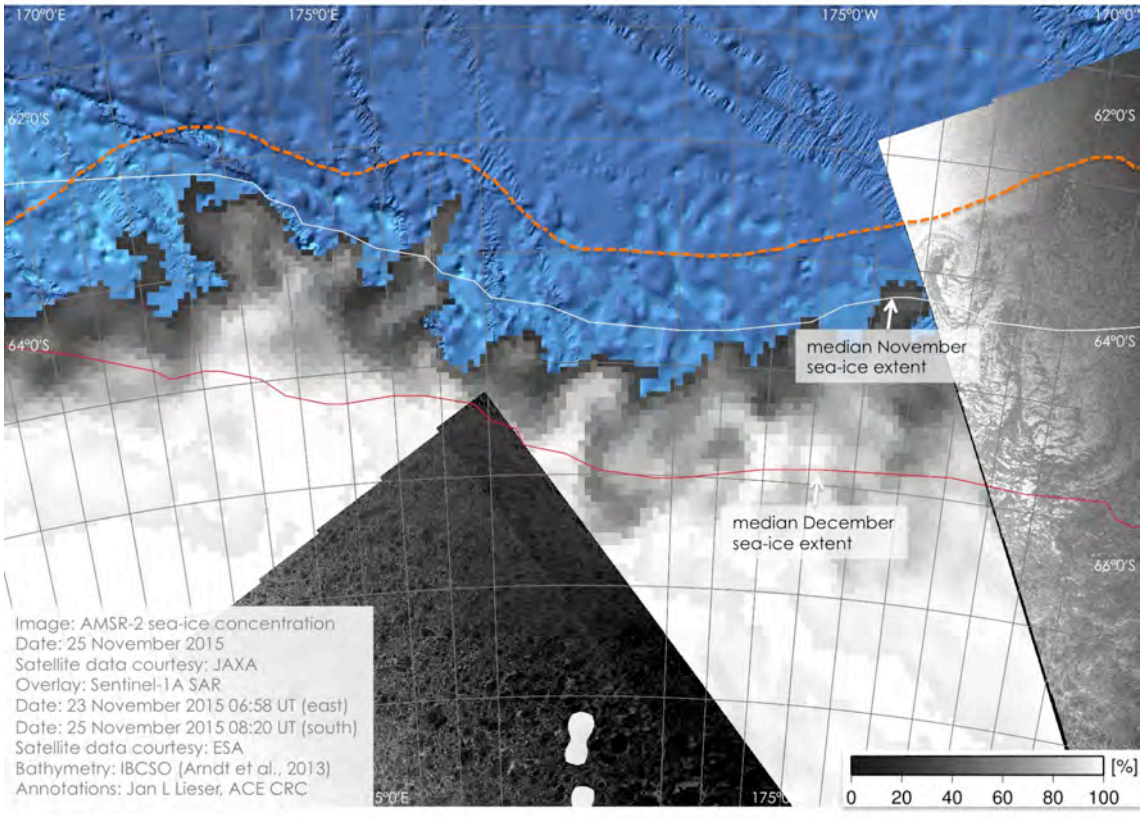

Figure 1: AMSR-2 sea-ice concentration, acquired 25/11/2015 and provided by Drift & Noise Polar Services. Overlay: Sentinel-1a SAR scenes provided by PolarView.

As mentioned in our previous report (#48.3/2015) the sea-ice edge remains highly mobile under the current low wind conditions.

With best regards,

Jan.

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Sea Ice Report #48.7/2015

by the AAD/ACE CRC Sea Ice Group*

26/11/2015

- **Casey Station**
  East of 110° E, offshore winds are spreading the sea-ice edge northward. This can be seen in Figure 1 where strips and patches of sea ice extend far beyond (north of) the median sea-ice extent for November (orange line). The location of a 'Whale mooring' (to be recovered and re-deployed, R&D) is indicated by a blue dot in the figure. Currently, this site is covered by a patch of sea ice, but it is within the marginal ice zone and higher concentration pack ice remains to the south of it.

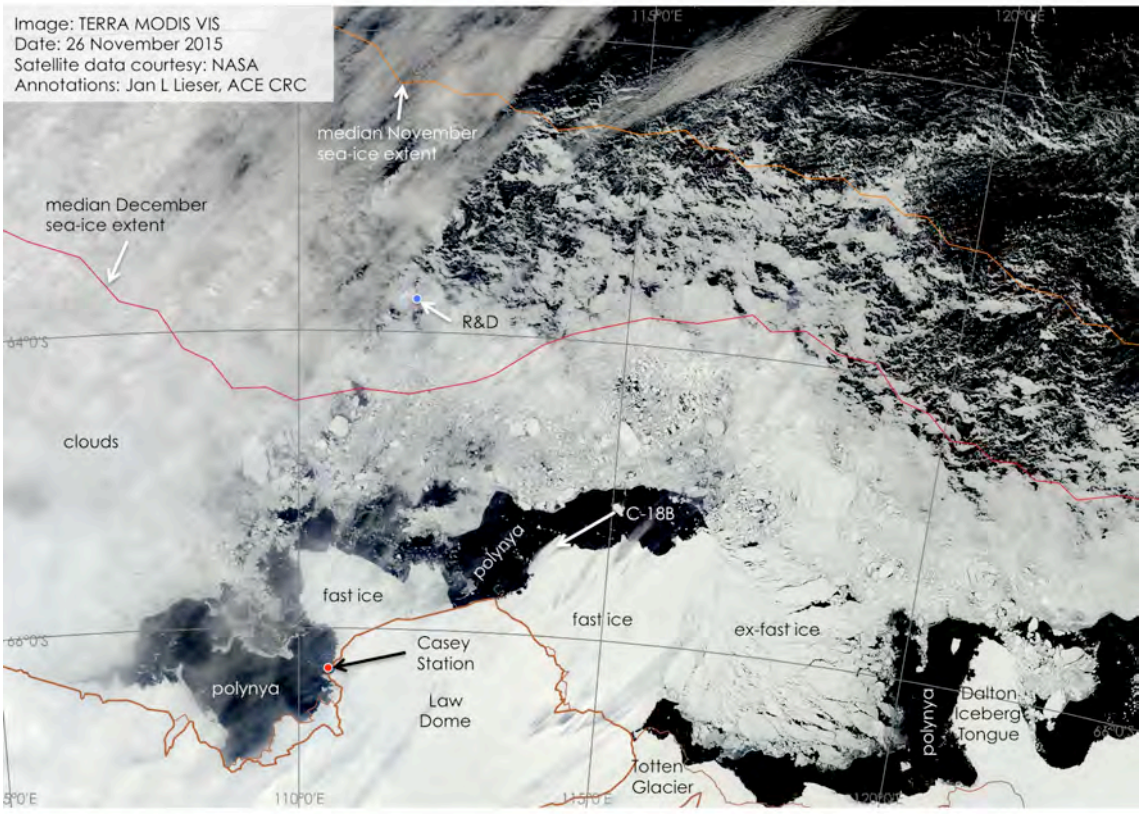

Figure 1: MODIS VIS scene, acquired 26/11/2015 and provided by NASA.

Around Law Dome, coastal polynyas are wide and well established.

With best regards,

Jan.

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Sea Ice Report #49.1/2015

by the AAD/ACE CRC Sea Ice Group*

30/11/2015

This report updates on sea-ice conditions off Mawson and Casey stations.

- **Mawson Station**
  Off Mawson Station, the fast-ice edge continues to retreat towards the coast (see Figure 1). The white line in the figure denotes the fast-ice edge on 23/11/2015. The polynya off this fast ice is roughly 30 nautical miles wide and the pack ice to the north of it shows only isolated patches of 100% sea-ice concentration within a dissolving pack.

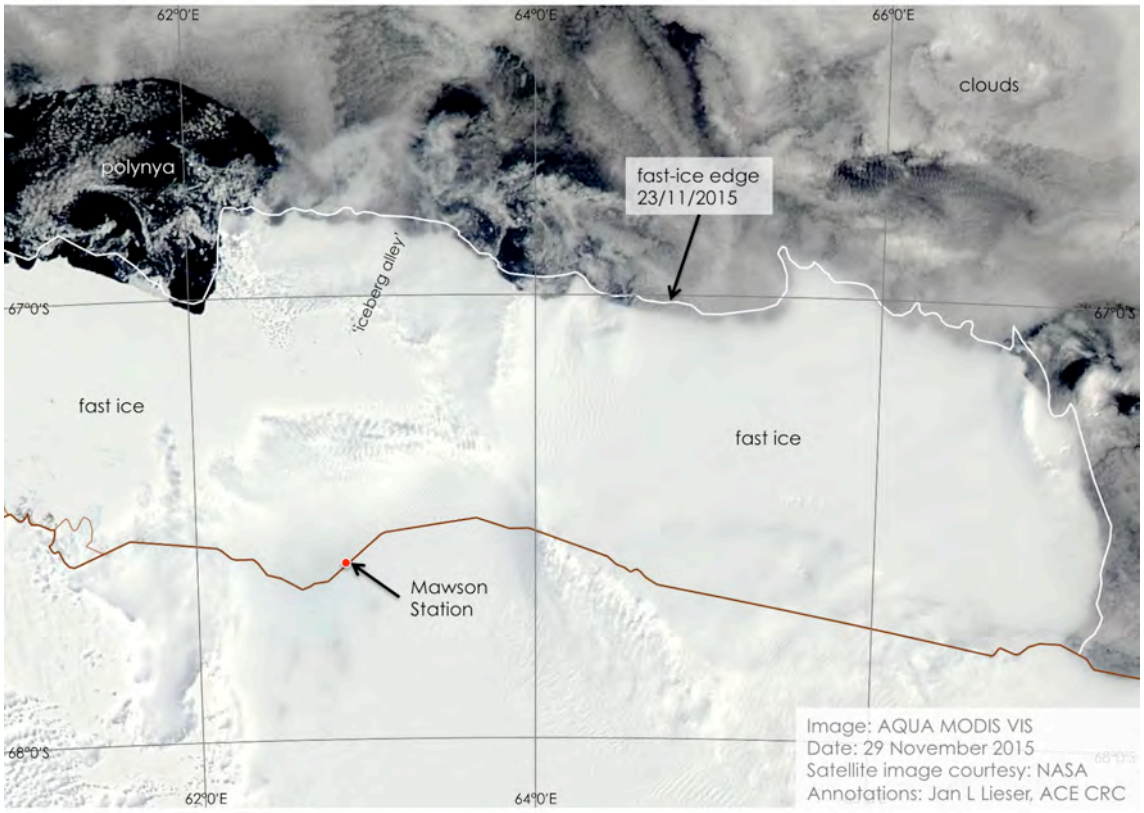

Figure 1: MODIS VIS scene, acquired 29/11/2015 and provided by NASA.

East of Cape Darnley (not shown), the fast ice is showing signs of breaking up as well. One very large piece (roughly 23 nautical miles by 5 nautical miles) has broken away from the eastern side of this fast ice and is drifting through Prydz bay now.

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- **Casey Station**
  Offshore winds have removed the pack ice from the coast, around Law Dome. Figure 2 shows the coastal polynyas off Casey Station and offshore Sabrina Coast clearly, in the cloud-free, southern part of the figure.

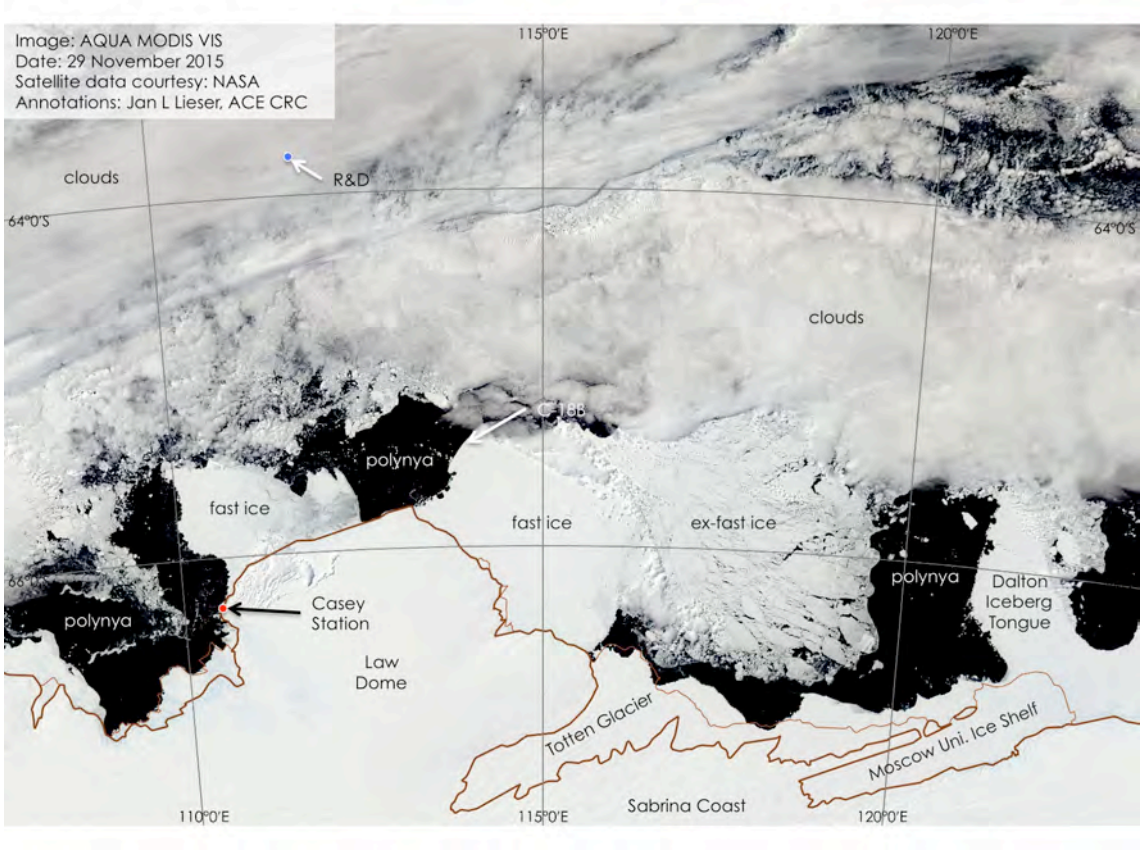

Figure 2: MODIS VIS scene, acquired 29/11/2015 and provided by NASA.

The location of a 'Whale mooring' (to be recovered and re-deployed, R&D) is indicated by a blue dot in the figure. The site is within the highly dynamic marginal ice zone, under clouds.

With best regards,

Jan.

Sea Ice Report #49.2/2015

by the AAD/ACE CRC Sea Ice Group*

30/11/2015

This report updates on fast-ice conditions off Zhongshan Station and sea-ice conditions in the larger Prydz Bay region.

- **Zhongshan Station**
  Figure 1 shows a MODIS visible scene of eastern Prydz Bay. The fast-ice edge off Zhongshan Station is now showing signs of retreat, while fast ice off Cape Darnley in the west and off Davis Station in the north continues to break up. The fast-ice edge is now roughly 15.5 nautical miles north of the Zhongshan Station (orange arrow).

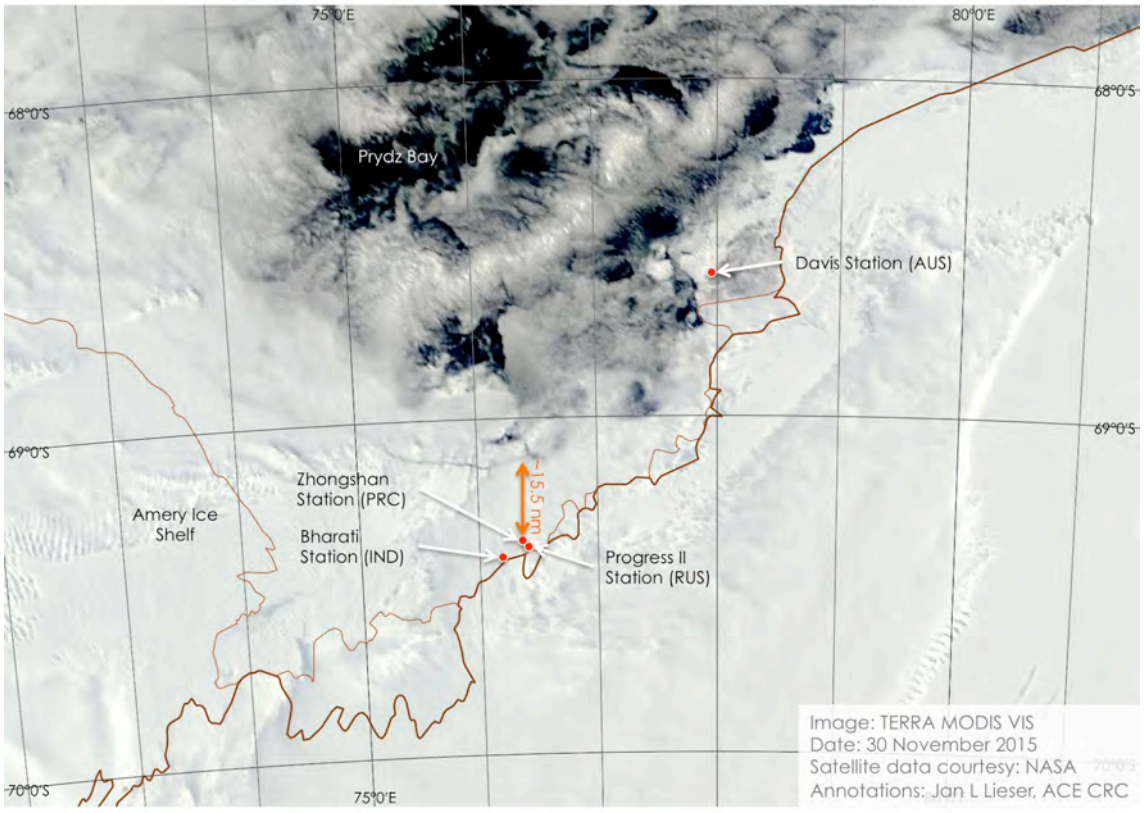

Figure 1: MODIS VIS scene, acquired 30/11/2015 and provided by NASA.

An overview of sea-ice concentration is provided in Figure 2. The cruise track of MV *XueLong* (BNSK) is shown as a green track (up until 30/11/2015 03:30 UT) in the figure (entering from the northeast). In the central part of Prydz Bay, sea ice is breaking into smaller floes but a thinning band of old sea ice is still protruding into Prydz Bay from

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the east. The core of this old sea ice lies north of the West Ice Shelf with a tongue of old floes reaching to about 74° 30' E and 66° S.

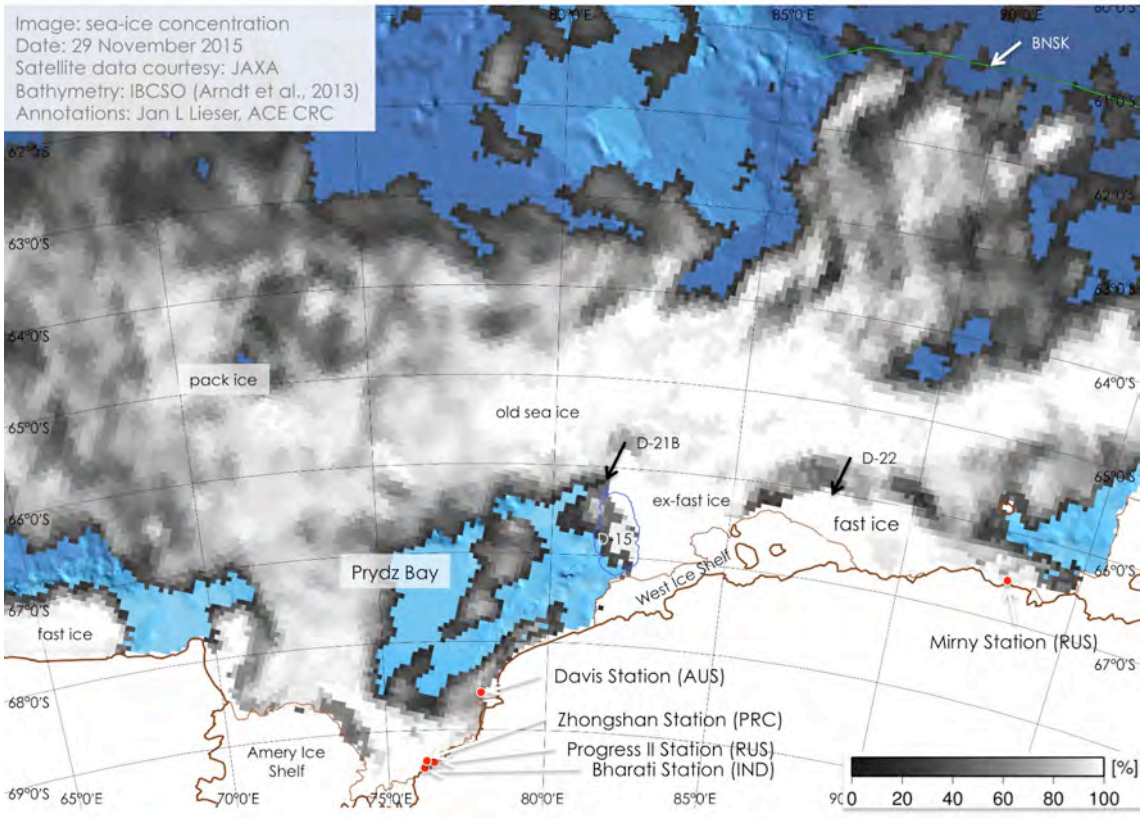

Figure 2: AMSR-2 sea-ice concentration, acquired 30/11/2015 and provided by Drift & Noise Polar Services.

With best regards,

Jan.

Sea Ice Report #49.3/2015

by the AAD/ACE CRC Sea Ice Group*

01/12/2015

This report updates on fast-ice conditions in the vicinity of Commonwealth Bay.

- **Commonwealth Bay**
  The hook-like fast-ice feature between Dumont D'Urville Station and Commonwealth Bay has mostly shattered and only one fast-ice promontory remains at 141° 30' E (Figure 1). The fast-ice edge between the station and Commonwealth Bay is indicated by the red scribble line in the figure. The distance between Mawson's Huts and the fast-ice edge is roughly 11.5 nautical miles.

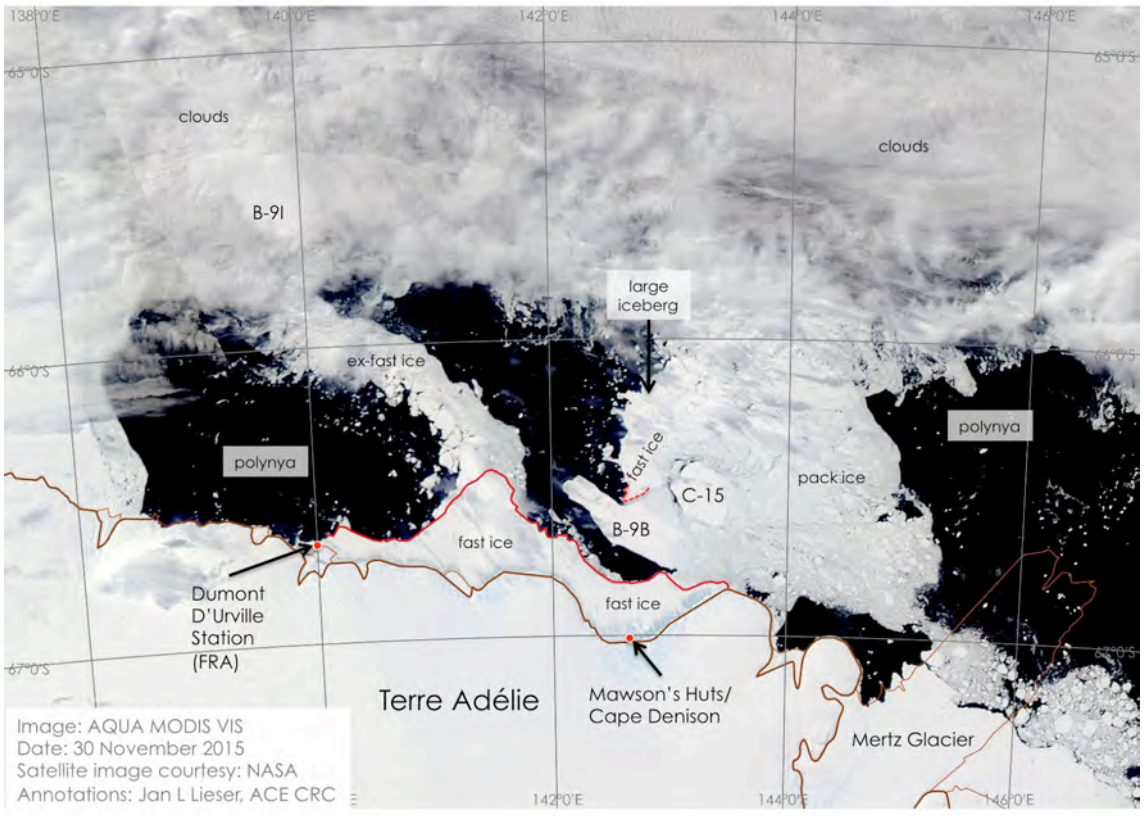

Figure 1: MODIS VIS scene, acquired 30/11/2015 and provided by NASA.

Since 15/11/2015, iceberg B-9I has travelled further northwestwards (roughly 26 nautical miles). Iceberg B-9B wiggles but remains jammed behind only the southern corner of a body of fast ice (indicated by

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the dashed red line) between B-9B, C-15 and a large berg in the north. This fast ice shows similar signs of disintegration as the 'hook'.

Figure 2 shows Dumont D'Urville Station and l'Astrolabe Glacier. Thin clouds appear with a reddish tint. The distance between the station and the fast-ice edge in the north is approximately 0.5 nautical mile.

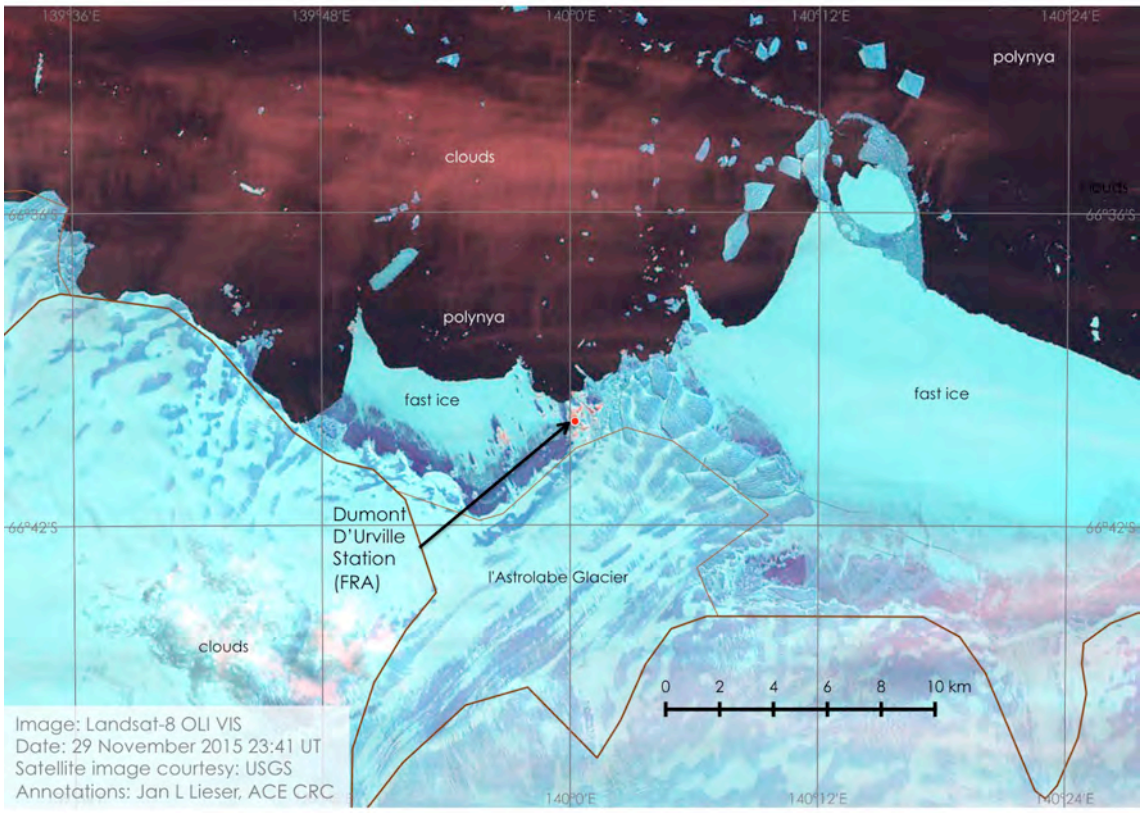

Figure 2: Operational Land Imager VIS scene, acquired 29/11/2015 and provided by USGS.

With best regards,

Jan.

Sea Ice Report #49.4/2015

by the AAD/ACE CRC Sea Ice Group*

02/12/2015

- **Casey Station**
  Figure 1 shows a high-resolution SAR scene of Law Dome and the sea-ice area to the north of it. The location of a whale mooring (R&D) is given by a blue dot. The orange dashed line indicates the approximate southern boundary of the marginal ice zone, between 108° E and 114° E. The red dashed line marks a boundary south if which some large floes of old sea ice can be found.

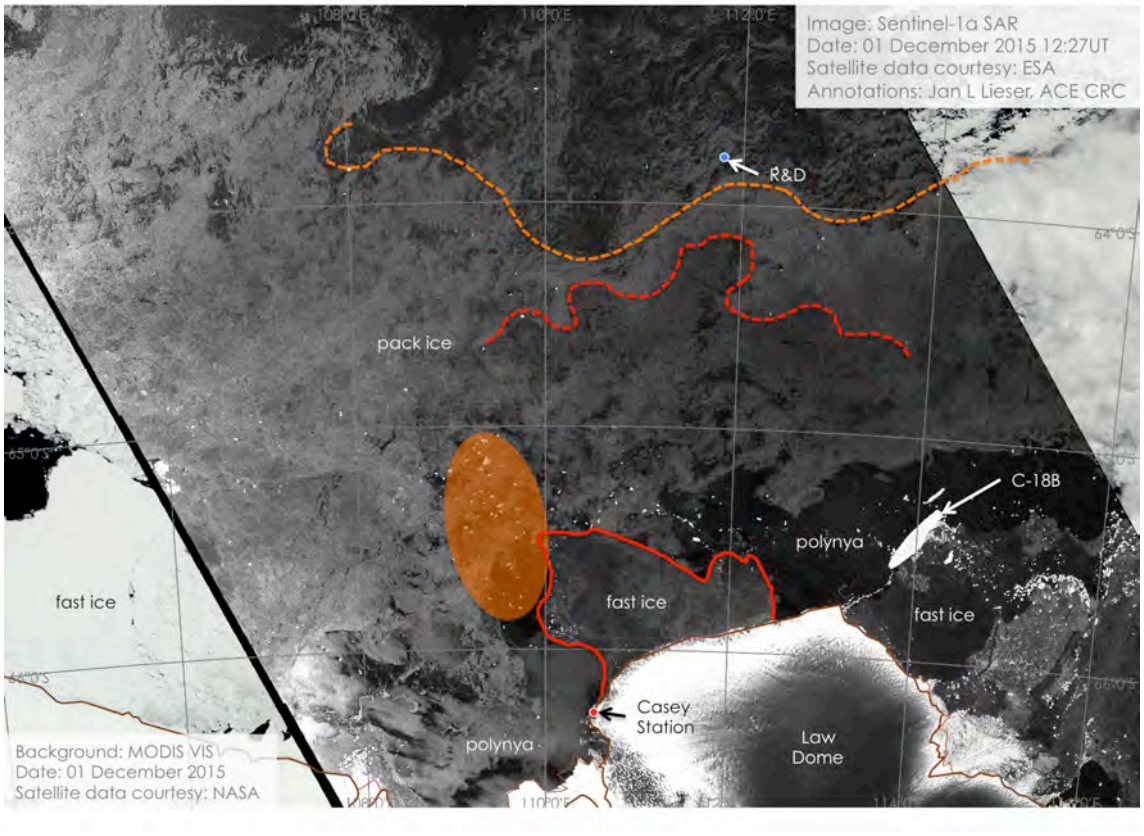

Figure 1: Sentinel-1a SAR scene, acquired 01/12/2015 and provided by PolarView.

The orange shaded ellipse points to a cluster of large icebergs, west of 110° E.

With best regards,

Jan.

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Sea Ice Report #49.5/2015

by the AAD/ACE CRC Sea Ice Group*

02/12/2015

This report updates on sea-ice conditions of the northwestern Ross Sea.

- **Ross Sea**
  Figure 1 shows yesterday's sea-ice concentration chart with overlay of high-resolution synthetic aperture RADAR data, in the east.

  The dashed orange line indicates a boundary south of which some sea ice can reasonably be expected. The white and red lines in the figure show the long-term median sea-ice extent for November and December, respectively, in the region.

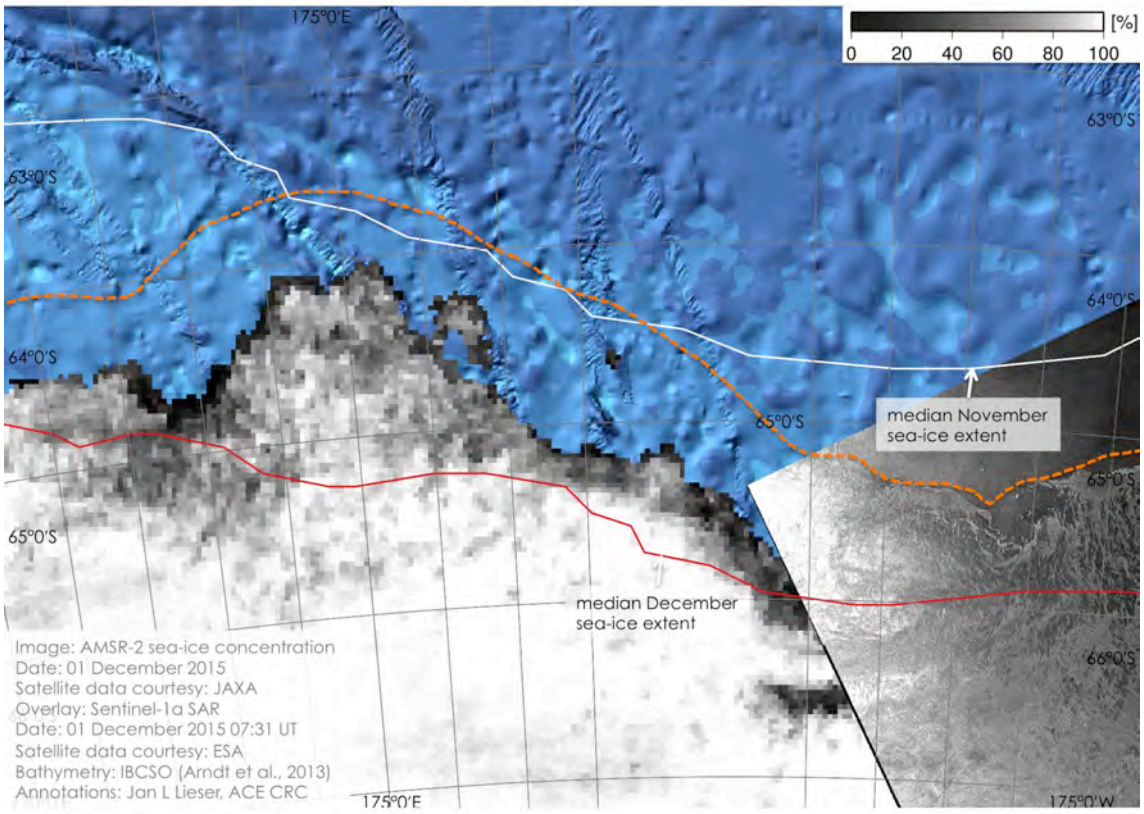

Figure 1: AMSR-2 sea-ice concentration, acquired 01/12/2015 and provided by Universität Hamburg. Overlay: Sentinel-1a SAR scene, acquired 01/12/2015 and provided by PolarView.

The local effects of a deep low pressure system currently in the region is pushing the sea-ice edge southwards ahead of its centre

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(at the moment east of 180° E) and pulling the sea-ice edge northwards behind it (roughly at 175° E). As the centre of this low moves to the east, this pattern of a pushed and pulled sea-ice edge will move along further to the east as well.

With best regards,

Jan.

Sea Ice Report #49.6/2015

by the AAD/ACE CRC Sea Ice Group*

04/12/2015

This report updates on fast-ice conditions off Zhongshan Station and sea-ice conditions in the larger Prydz Bay region.

- **Zhongshan Station**
  Figure 1 shows a high-resolution SAR scene of southeastern Prydz Bay. The red line in the figure denotes the recent cruise track of MV *XueLong* (BNSK) in the region. The fast-ice edge off Zhongshan Station is retreating further towards the coast and is now roughly 13 nautical miles north of the station (orange arrow).

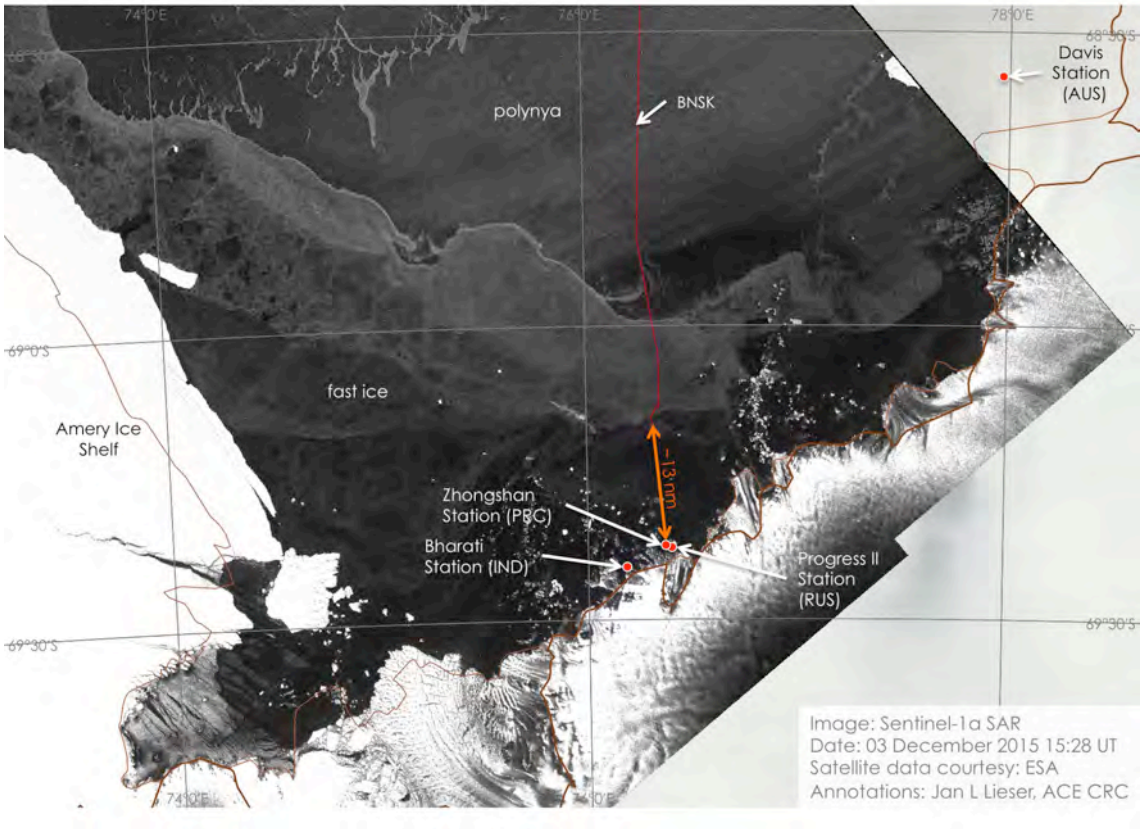

Figure 1: Sentinel-1a SAR scene, acquired 03/12/2015 and provided by PolarView.

An overview of sea-ice concentration is provided in Figure 2. In the central part of Prydz Bay, sea ice is breaking into smaller floes but a thinning band of old sea ice is still protruding into Prydz Bay from the east. The core of this old sea ice lies north of the West Ice Shelf with a

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tongue of old floes reaching to about 74° 30' E and 66° S. The sea-ice edge and the marginal ice zone are progressing southward and the overall extent in the region is already close to the long-term median sea-ice extent for December (white line in Figure 2).

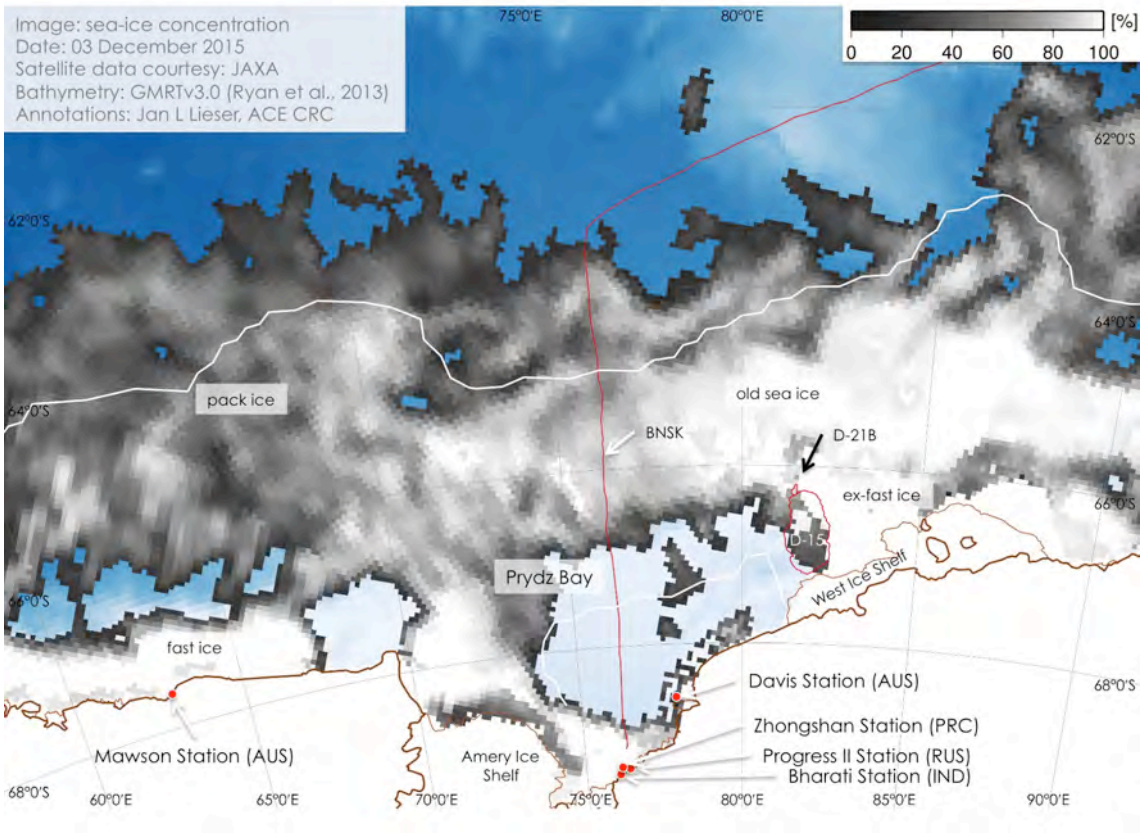

Figure 2: AMSR-2 sea-ice concentration, acquired 03/12/2015 and provided by Drift & Noise Polar Services.

With best regards,

Jan.

Sea Ice Report #49.7/2015

by the AAD/ACE CRC Sea Ice Group*

04/12/2015

- **Mawson Station**
  Figure 1 shows a high-resolution SAR scene offshore Mawson Station. The red line in the figure shows the fast-ice edge from 23/11/2015 to illustrate the retreat of the fast ice southwards. The northern part of 'iceberg alley' is already free of sea ice. The pack ice visible in the figure is very open and consists to a large proportion only of strips and patches, where higher sea-ice concentration is only seen in the eastern part of the figure (east of 69° E).

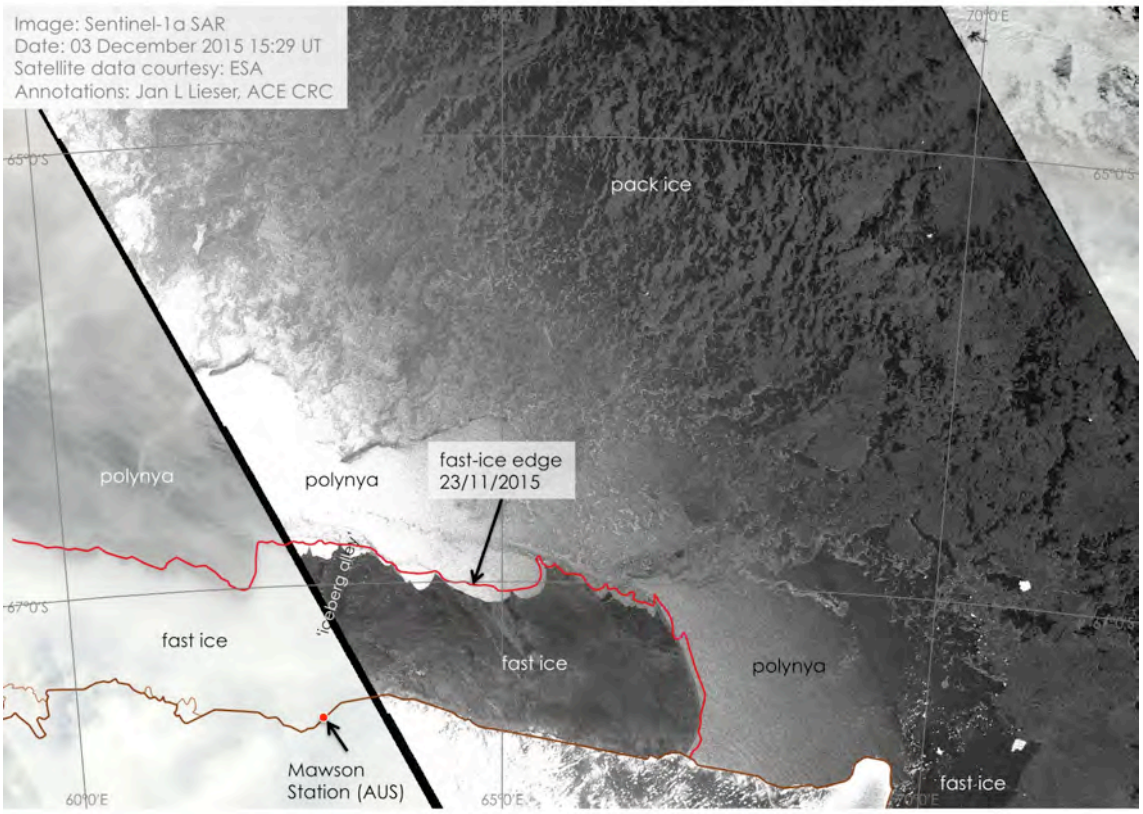

Figure 1: Sentinel-1a SAR scene, acquired 03/12/2015 and provided by PolarView. Background: MODIS VIS scene, acquired 03/12/2015 and provided by NASA.

An overview of sea-ice concentration is provided in Figure 2. The long-term median sea-ice extent for December is shown with white lines

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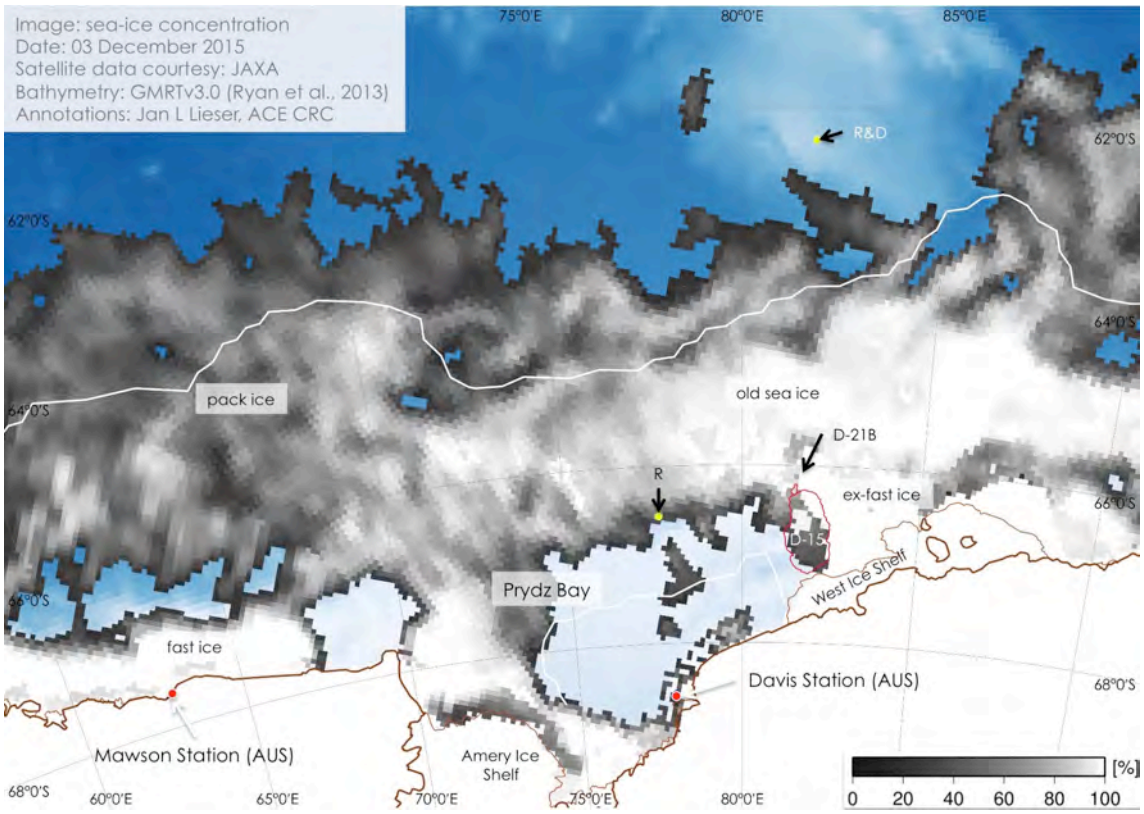

Figure 2: AMSR-2 sea-ice concentration, acquired 03/12/2015 and provided by Drift & Noise Polar Services.

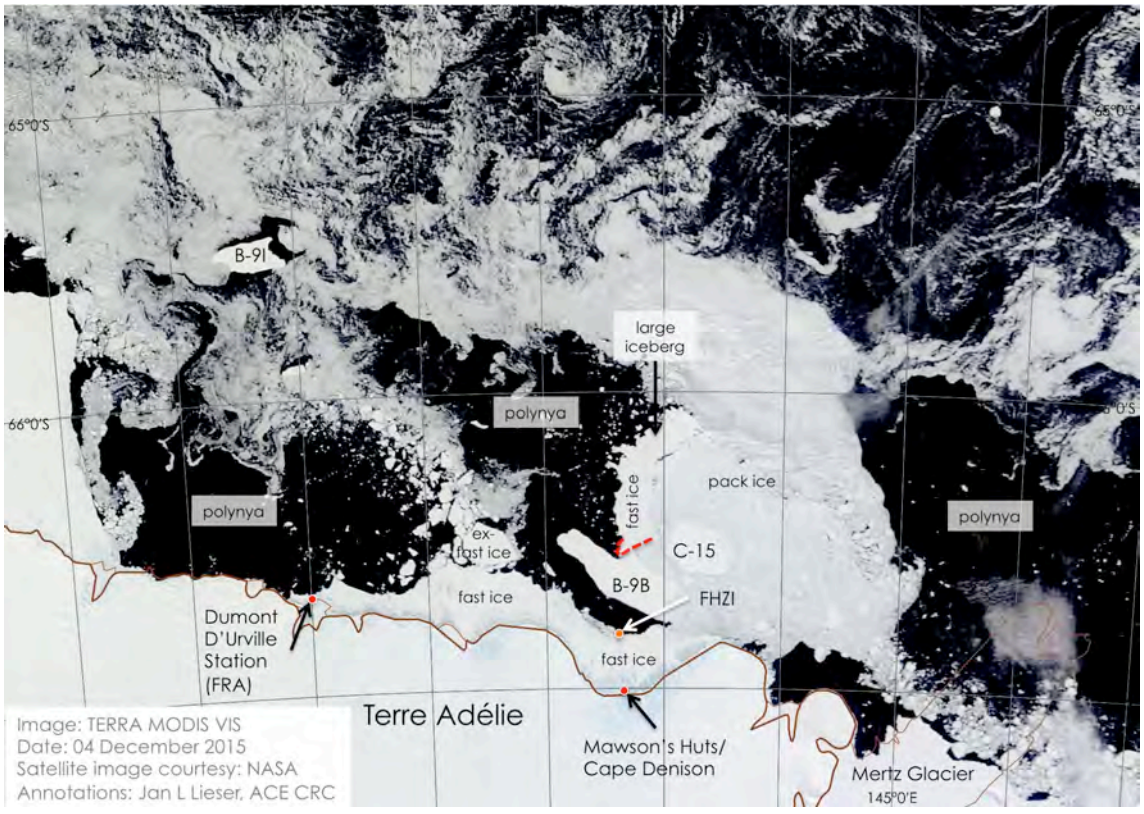

Figure 3: MODIS VIS scene, acquired 04/12/2015 and provided by NASA.

and the locations of two 'whale moorings' are indicated by yellow dots. The northern one (R&D, to be recovered and re-deployed) is in ice-free waters and the southern one (R, to be retrieved only) is in the marginal sea ice zone close to the offshore polynya between the Amery Ice Shelf and the West Ice Shelf.

- **Commonwealth Bay**
  Figure 3 shows a visible scene of the fast ice, offshore from Mawson's Huts. The position of MV *l'Astrolabe* (FHZI) is shown by the orange dot.

  The break up of the former hook-like fast-ice feature between Dumont D'Urville Station and Commonwealth Bay is obvious. Some pack ice is trapped at the eastern side of remaining fast ice between iceberg B-9B and a large iceberg in the north (annotated). This body of fast ice is breaking up, but a number of grounded bergs in the area still hold the fast ice in place. Icebergs B-9B and C-15 appear to a certain degree mobile and move about their location. Iceberg B-9I is now north of the continental shelf break and continues its journey to the west.

With best regards,

Jan.

Sea Ice Report #50.1/2015

by the AAD/ACE CRC Sea Ice Group*

07/12/2015

This report updates on fast-ice conditions in Commonwealth Bay.

- **Commonwealth Bay**
  Figure 1 shows a visible scene of the fast ice, offshore from Mawson's Huts. The position of MV *l'Astrolabe* (FHZI) is shown by the orange dot.

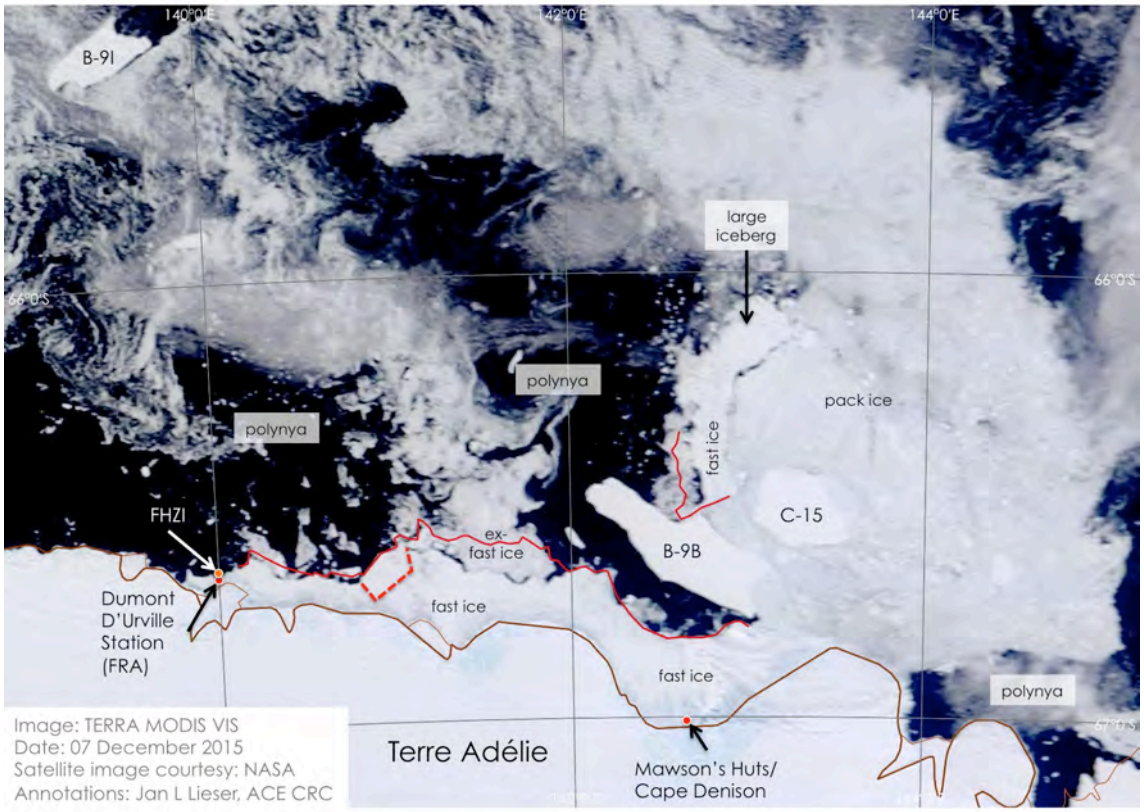

Figure 1: MODIS VIS scene, acquired 07/12/2015 and provided by NASA.

The fast ice break-up continues in the region. The red scribble lines indicate the location of fast-ice edges on 04/12/2015. The dashed red line shows further break-up occurring. The fast ice north of iceberg B-9B is diminishing rapidly now, as well as the fast ice between Dumont D'Urville Station and Mawson's Huts.

With best regards,

Jan.

*Disclaimer: *Every effort is made to ensure the data provided in this report are accurate at the date of publication; however the report is provided without warranty of any kind. The figures and charts provided in this report are intended only as a guide to ice conditions and are not suitable for navigation.*

Sea Ice Report #50.2/2015

by the AAD/ACE CRC Sea Ice Group*

09/12/2015

- **Ross Sea**
  Figure 1 shows yesterday's sea-ice concentration chart with overlay of high-resolution synthetic aperture RADAR data. The red line in the figure show the long-term median sea-ice extent for December.

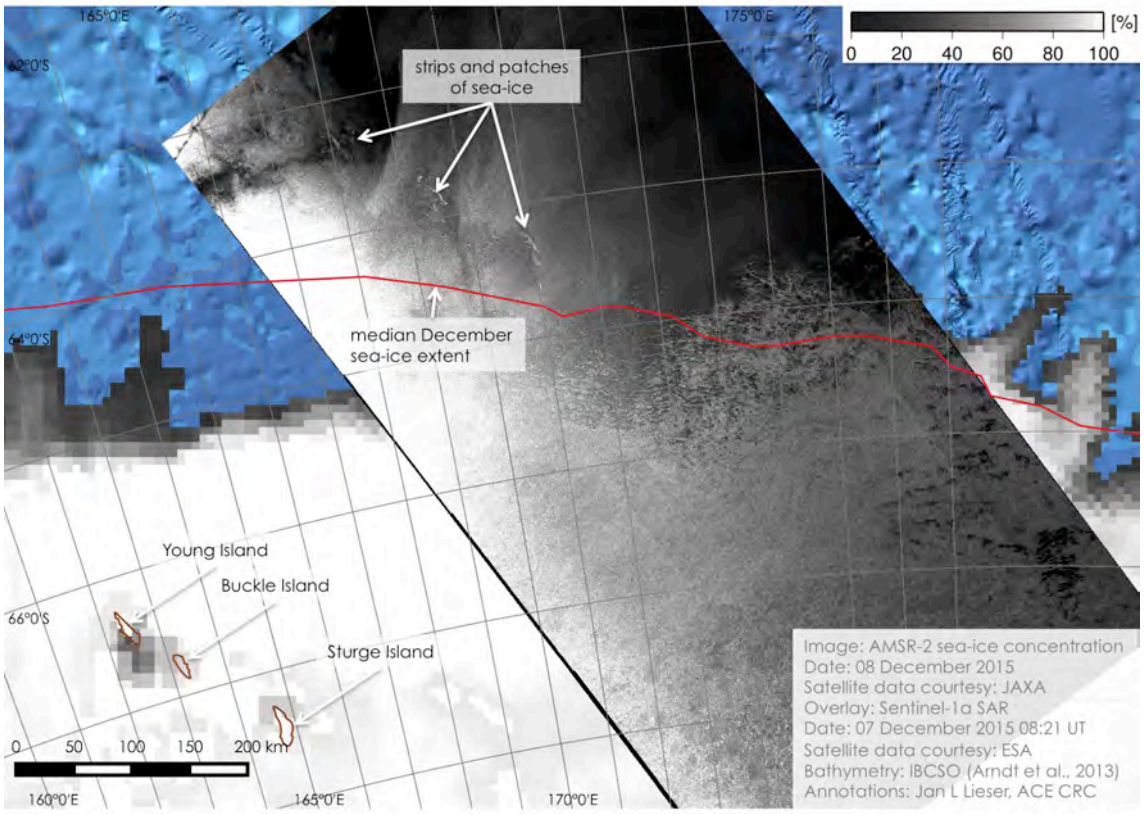

Figure 1: AMSR-2 sea-ice concentration, acquired 08/12/2015 and provided by Universität Hamburg. Overlay: Sentinel-1a SAR scene, acquired 07/12/2015 and provided by PolarView.

West of 173° E, the sea-ice edge (typically defined as 15% sea-ice concentration) is below (south of) the long-term median sea-ice extent for December. However, the high resolution SAR scene shows that isolated strips and patches of sea ice can be found as far north as 63° 15' S.

With best regards,

Jan.

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Sea Ice Report #50.3/2015

by the AAD/ACE CRC Sea Ice Group*

09/12/2015

- **Casey Station**
  Figure 1 shows a visible image of the sea ice off Law Dome; even though it is largely obscured by thin clouds it allows for an assessment of sea-ice conditions north of Casey Station.

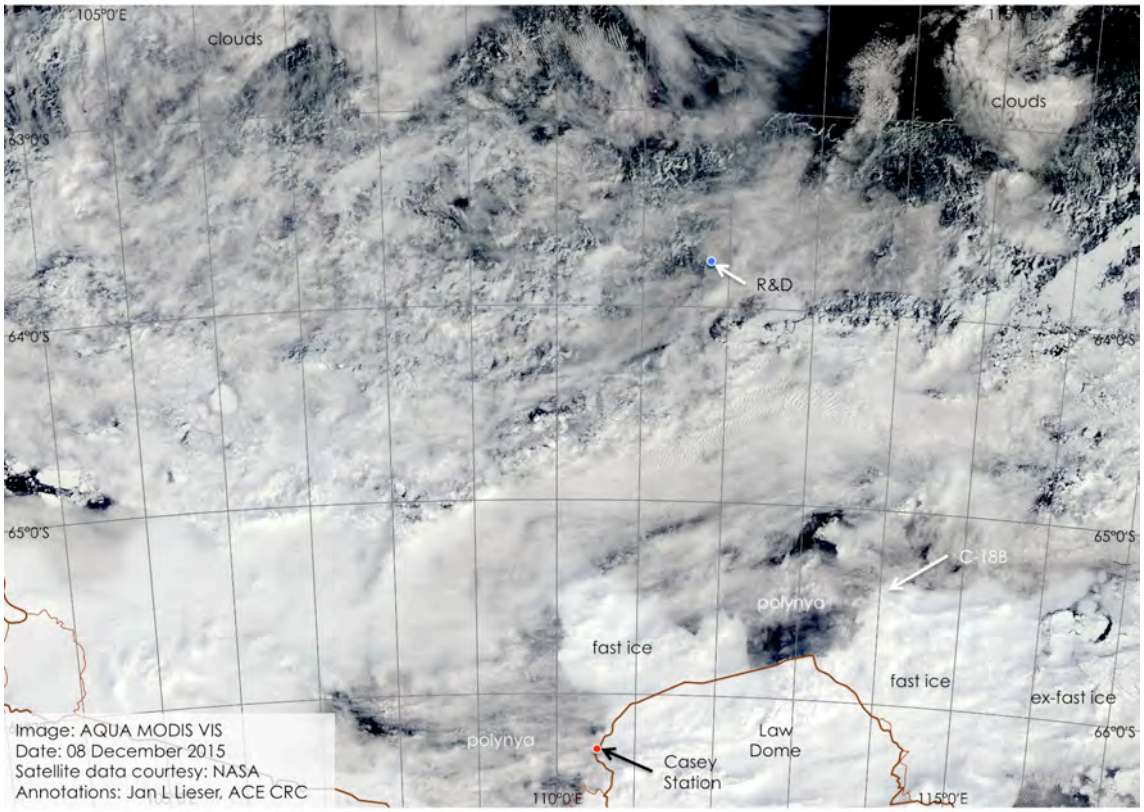

Figure 1: MODIS VIS scene, acquired 08/12/2015 and provided by NASA.

The marginal ice zone is roughly 100 nautical miles wide (north-south extent) and south of this zone, only isolated large sea-ice floes remain in the sea-ice matrix of medium-high sea-ice concentration. Fast ice off the northwestern edge of Law Dome is slowly breaking up. The polynya offshore Casey Station is well established.

The location of the 'whale mooring' (blue dot) is well within the marginal ice zone.

With best regards,

Jan.

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Sea Ice Report #50.4/2015

by the AAD/ACE CRC Sea Ice Group*

10/12/2015

This report updates on fast-ice conditions off Zhongshan Station and sea-ice conditions in the larger Prydz Bay region.

- **Zhongshan Station**
  Figure 1 shows a high-resolution visible scene of southern Prydz Bay. The current position of MV *XueLong* (BNSK) can be seen about 1 nautical mile south of the fast-ice edge. The fast-ice edge is still roughly 13.5 nautical miles north of the station.

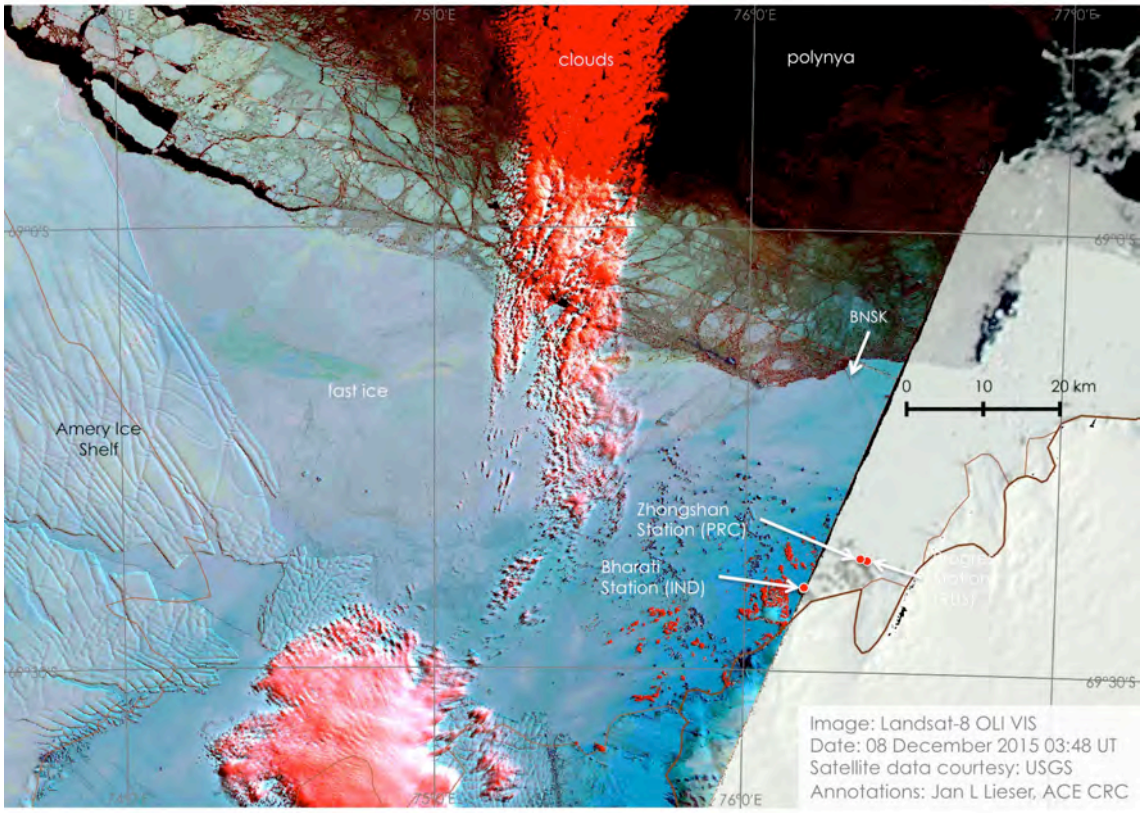

Figure 1: Landsat-8 OLI VIS scene, acquired 08/12/2015 and provided by USGS.

A larger overview of sea-ice concentration is provided in Figure 2. In the central part of Prydz Bay, sea ice consists of small floes now but a thinning band of old sea ice remains protruding into Prydz Bay from the east. The SAR scene shows no large or very large floes anymore, west of 80° E. The marginal ice zone is roughly 60 nautical miles wide (north-south extent).

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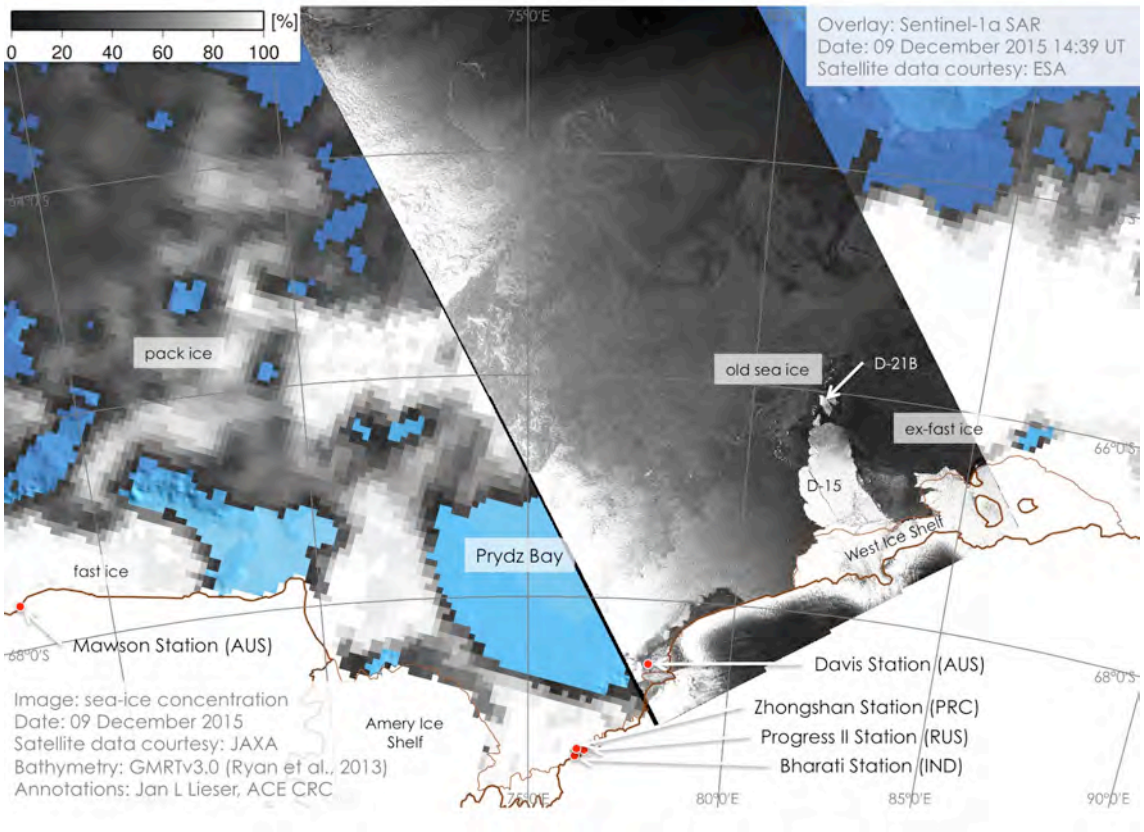

Figure 2: AMSR-2 sea-ice concentration, acquired 09/12/2015 and provided by Drift & Noise Polar Services. Overlay: Sentinel-1a SAR scene, acquired 09/12/2015 and provided by PolarView.

With best regards,

Jan.

Sea Ice Report #50.5/2015

by the AAD/ACE CRC Sea Ice Group*

10/12/2015

- **Commonwealth Bay**
  Figure 1 shows a high-resolution visible scene of the fast ice, between Dumont D'Urville Station and Mawson's Huts. The position of MV *l'Astrolabe* (FHZI) is shown by the orange dot.

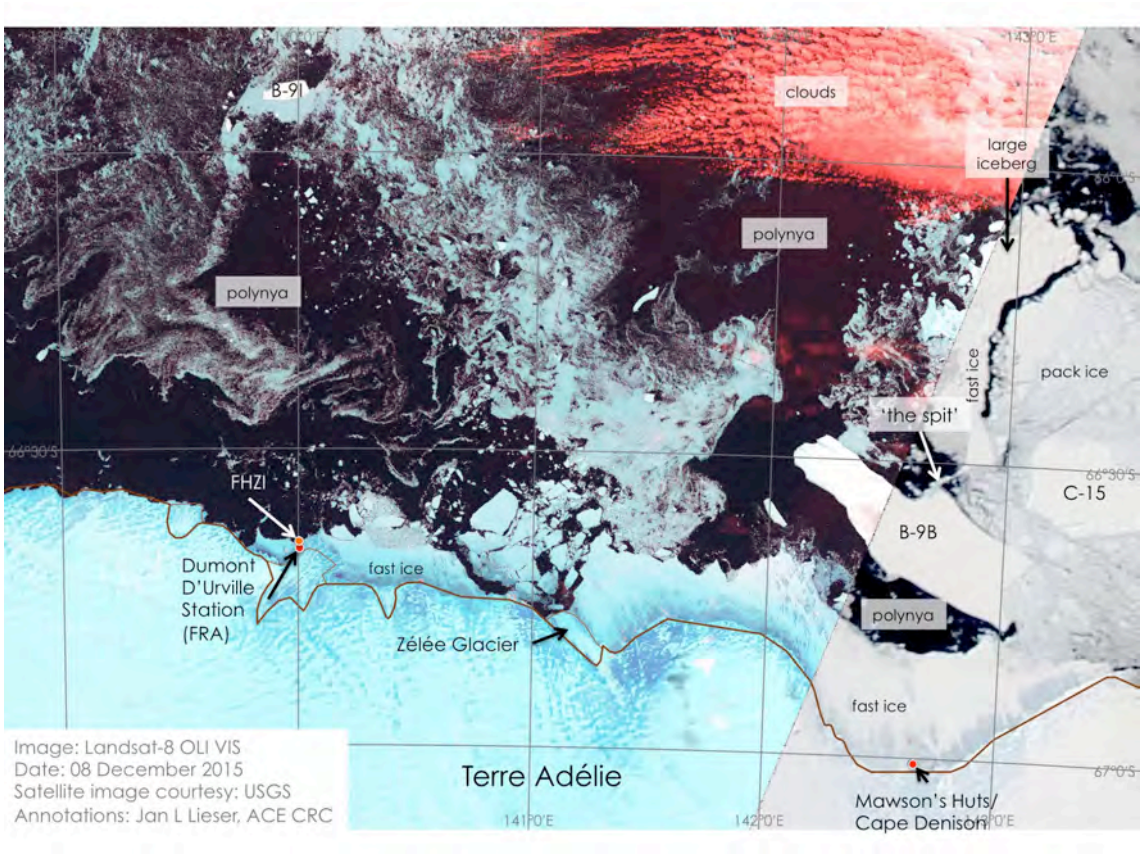

Figure 1: Landsat-8 OLI VIS scene, acquired 08/12/2015 and provided by USGS; complemented by TERRA MODIS VIS scene, acquired 09/12/2015 and provided by NASA.

The fast ice break-up continues in the region. As indicated in Sea Ice Report #50.1/2015, fast ice shattered off Zélée Glacier and is now drifting as large floes offshore. Iceberg B-9B appears trapped behind a line of small bergs connected by fast ice ('the spit'), but currently overlapping only by about 0.5 nautical miles.

With best regards,

Jan.

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Sea Ice Report #50.6/2015

by the AAD/ACE CRC Sea Ice Group*

11/12/2015

This report updates on fast-ice conditions off Commonwealth Bay.

- **Commonwealth Bay**
  Figures 1 and 2 show high resolution visible scenes offshore Commonwealth Bay at maximum quality/resolution (30 m). The bay (Figure 1) is still covered by fast ice. Close inspection reveals tide cracks more prominent in the western half of the bay than in the eastern part. Where snow is blown off the fast ice, different sea-ice surfaces are exposed, particularly around Cape Denison and the rock outcrop, roughly 2.5 km offshore. Different shading could be related to differing freezing conditions when the fast ice formed. In the north eastern corner of the bay fast ice can be seen broken up, but remaining local.

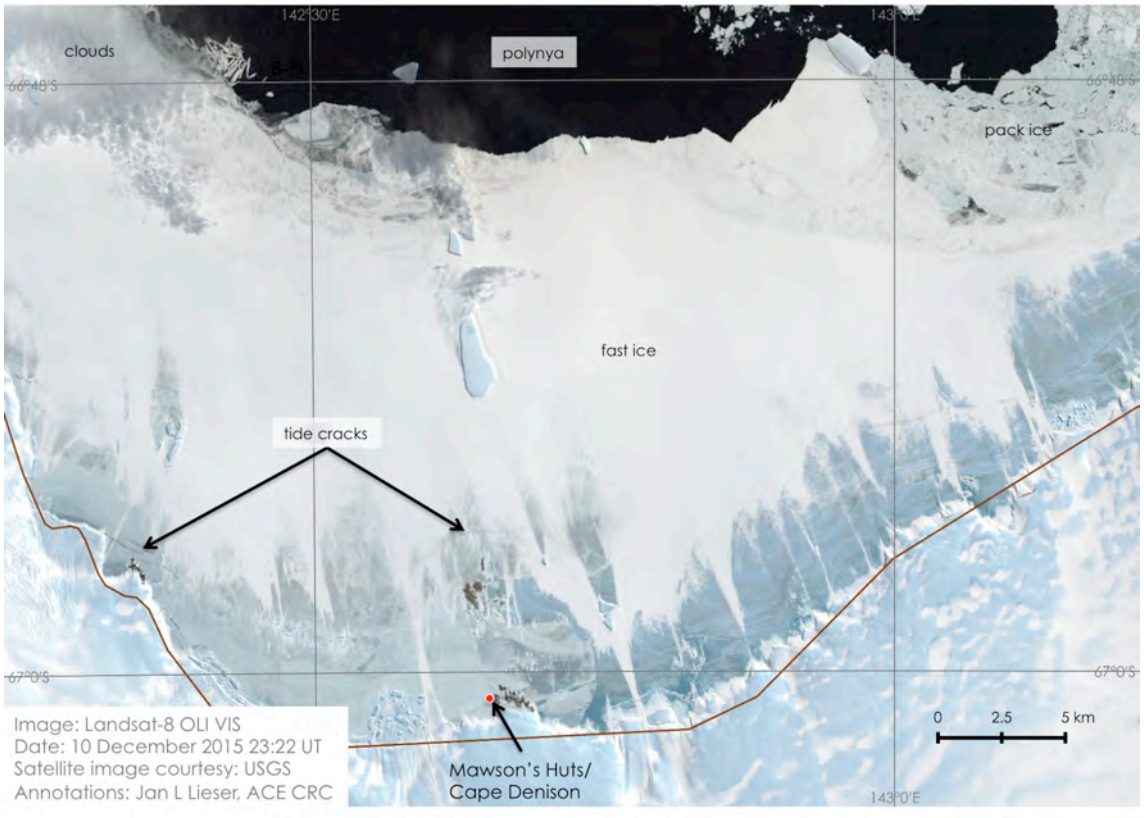

Figure 1: Landsat-8 OLI VIS scene, acquired 10/12/2015 and provided by USGS.

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Figure 2 offers a close-up view of 'the spit' (see Sea Ice Report #50.4/2015). The line of icebergs can clearly be identified and the fast ice between those bergs appears broken up.

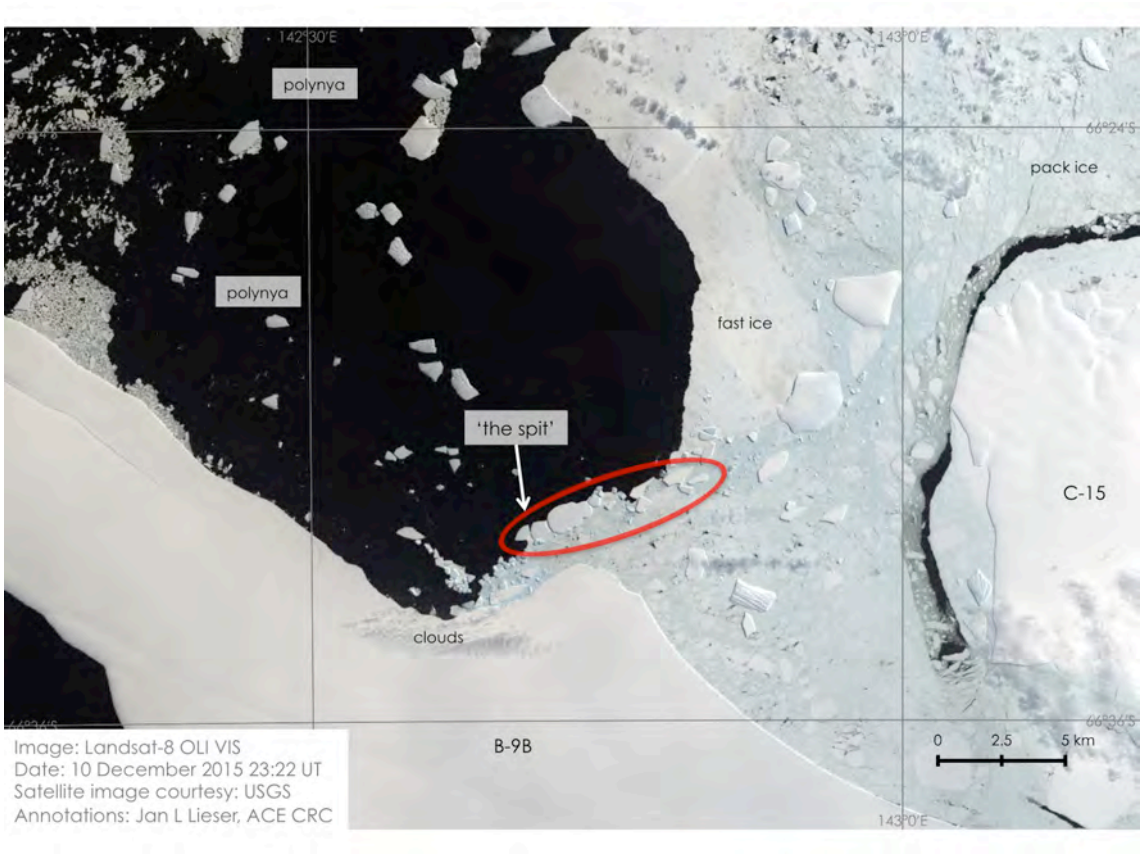

Figure 2: Landsat-8 OLI VIS scene, acquired 10/12/2015 and provided by USGS.

With best regards,

Jan.

Sea Ice Report #51.1/2015

by the AAD/ACE CRC Sea Ice Group*

14/12/2015

This report examines sea-ice conditions off Mawson and Davis stations.

- **Mawson Station**
  Figure 1 displays a high-resolution SAR scene, offshore Mawson Station. The northern part of 'iceberg alley' can be seen free of sea ice where the fast-ice edge is retreating southward. The southern corner of the polynya northwest of the station is currently approximately 35.5 nautical miles away.

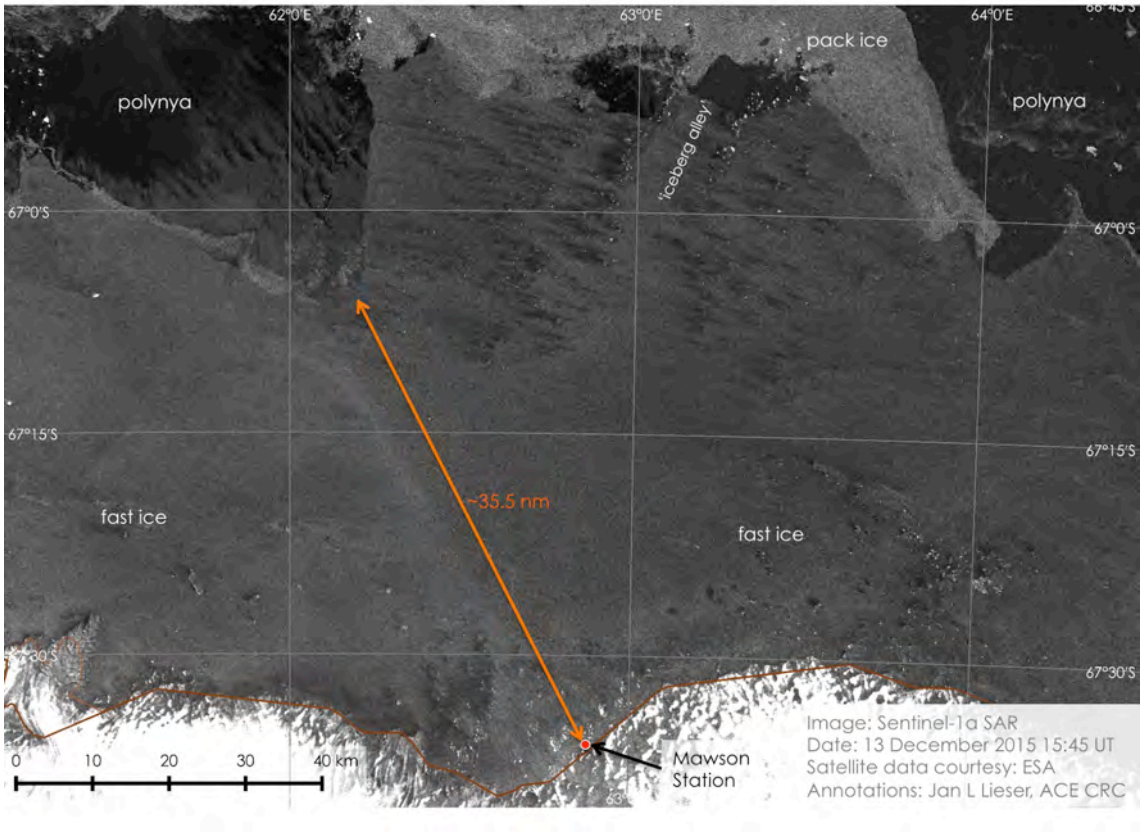

Figure 1: Sentinel-1a SAR scene, acquired 13/12/2015 and provided by PolarView.

Beyond (north of) the fast ice off Mawson Station and roughly 150 nautical miles to the west and to the east, pack ice is thinning rapidly with only isolated patches of high-concentration sea ice remaining. Southeast of Cape Darnley, fast ice is also breaking up.

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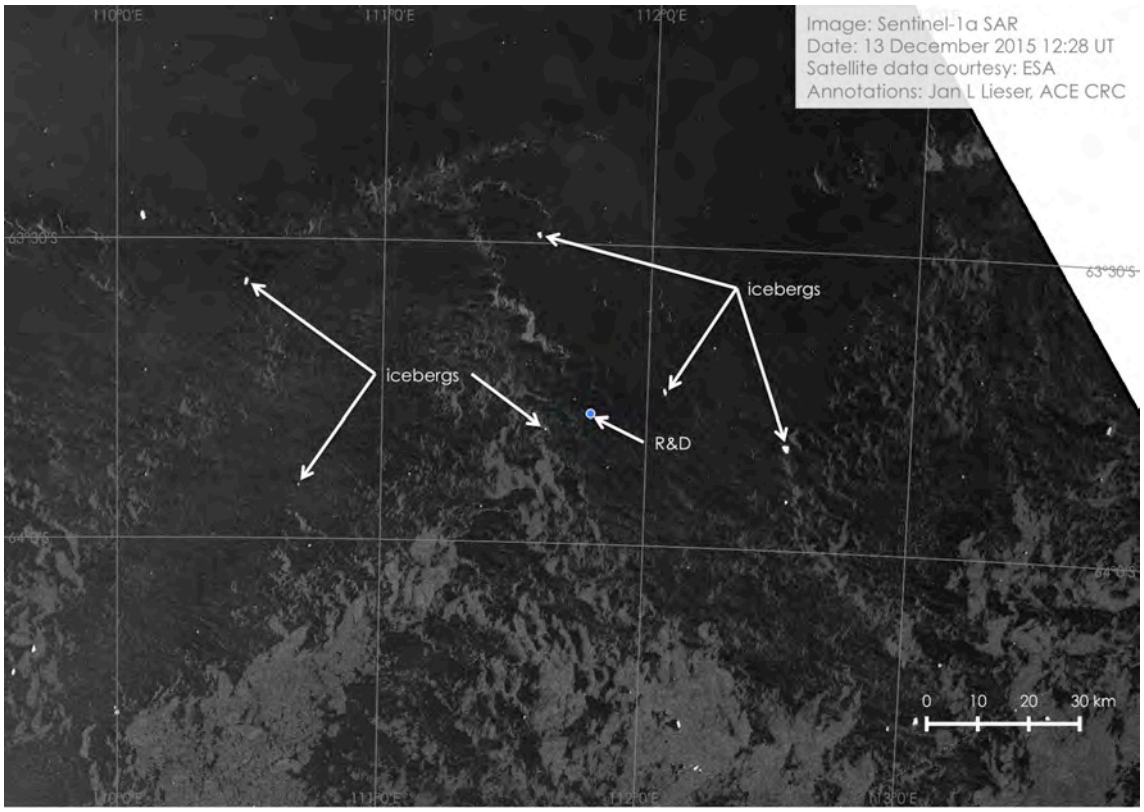

Figure 2: Sentinel-1a SAR scene, acquired 13/12/2015 and provided by PolarView.

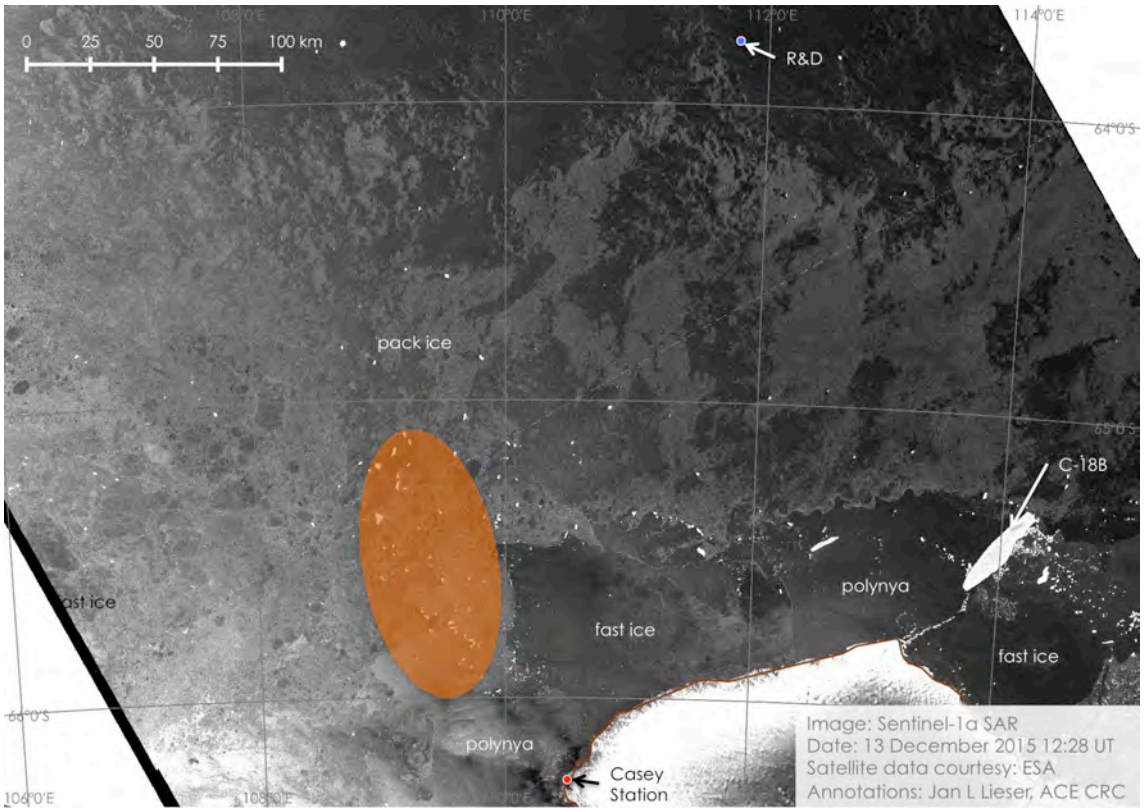

Figure 3: Sentinel-1a SAR scene, acquired 13/12/2015 and provided by PolarView.

- **Casey Station**
  Figure 2 shows a high-resolution SAR scene of the vicinity of a 'whale mooring' (R&D; blue dot). While it is still in the marginal ice zone, only little sea ice remains mostly as strips and patches. A few larger icebergs can be detected in the SAR scene, drifting freely.

  Figure 3 provides the bigger picture of Figure 2. Sea ice is thinning in the region but some fast ice is still attached to the sides of Law Dome. The orange shape in Figure 3 shows a region of many icebergs, between 109° E and 110° E.

With best regards,

Jan.

Sea Ice Report #51.2/2015

by the Antarctic Gateway Partnership Sea Ice Service*

16/12/2015

This report updates on sea-ice conditions of the northwestern Ross Sea.

- **Ross Sea**
  Figure 1 shows yesterday's sea-ice concentration chart with overlay of high-resolution synthetic aperture RADAR data, in the northeastern corner. The red line in the figure shows the long-term median sea-ice extent for December.

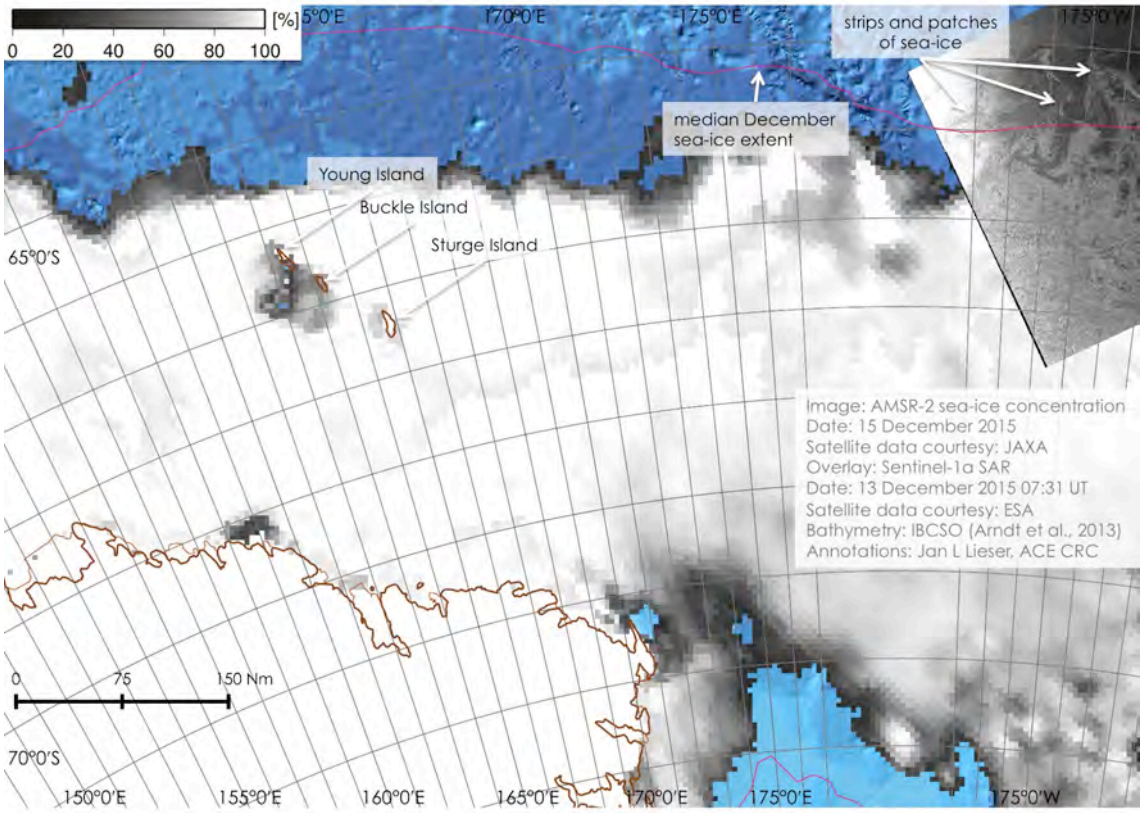

Figure 1: AMSR-2 sea-ice concentration, acquired 15/12/2015 and provided by Drift & Noise Polar Services. Overlay: Sentinel-1a SAR scene, acquired 13/12/2015 and provided by PolarView.

Sea-ice extent is now well within the boundaries of the long-term median extent. That means the northern sea-ice edge is south of the median and the polynya of southern Ross Sea is larger than typical, which results in the southern sea-ice edge now north of the median.

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The pack ice in-between remains at high concentration, in the northwestern Ross Sea.

A high pressure system that was centred at roughly 170° E and 62° S, yesterday, has compacted the sea-ice edge west of 170° E southward, which results in a rather clearly defined sea-ice edge in that region. However, east of the centre of this pressure system, southerly winds have created some strips and patches of sea ice, which can be seen in the SAR scene included in Figure 1.

With best regards,

Jan.

Sea Ice Report #51.3/2015

by the Antarctic Gateway Partnership Sea Ice Service*

16/12/2015

- **Casey Station**
  Figure 1 shows yesterday's sea-ice concentration chart. The white line in the figure shows the cruise track of RSV *Aurora Australis* (up until 16/12/2015 03:00 UT), just entering the area.

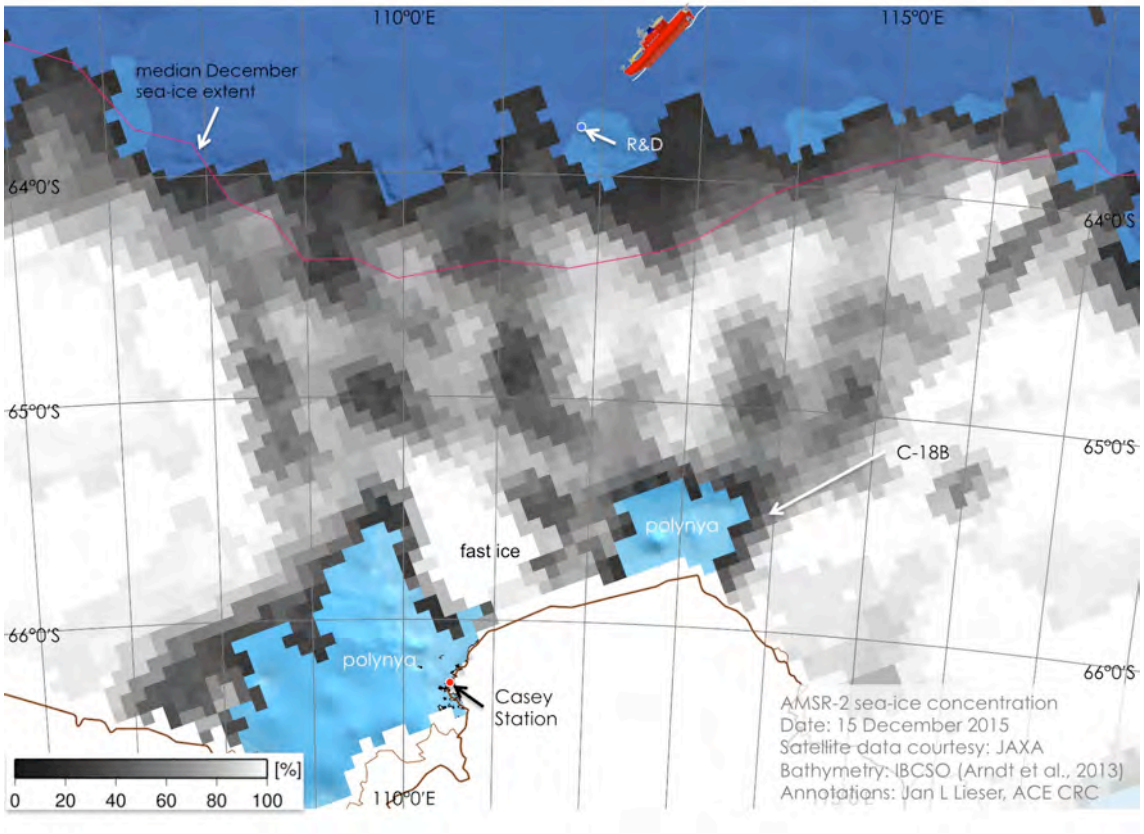

Figure 1: AMSR-2 sea-ice concentration, acquired 15/12/2015 and provided by Drift & Noise Polar Services.

Sea-ice extent is retreating southward but remains currently above (north of) the long-term median extent for December, in the region. While the location of a 'whale mooring' (R&D) appears ice free in the sea-ice concentration chart, some strips and patches may be present. Further south, towards Casey Station, sea ice is very patchy with only medium to high concentrations, at the moment.

With best regards,

Jan.

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Sea-Ice Report #01.1/2016

by the AAD/ACE CRC Sea-Ice Group*

08/01/2016

During austral summer 2015/16 along most of the East Antarctic, the sea ice retreated cohesively towards the coast. The two major exceptions are in the north-eastern Prydz Bay and west, off the Shackleton Ice Shelf, the latter forming a polynya off Mirny Station. Currently, the marginal ice zone is of narrow meridional (north-south) extent and the interior pack is well consolidated.

- **K-Axis Region** (80° E to 100° E)
  As of 07/01/2016 (Figure 1), the northernmost sea-ice edge just to the east (100° E to 105° E) of the K-Axis region of interest is to the south of 64° 10' S, with only a few short-lived (synoptic) excursions as far north as 64° 04' S, with consolidated pack ice found to the south of the ice edge. From 99.8° E to 98.5° E, the ice edge deflects northward to about 63° 15' S, associated with the northward trending coastline off Knox Coast and Shackleton Ice Shelf further to the west. There is a sizeable polynya off Mirny (91.2° E to 95.2° E). A finger of consolidated ice obstructs access into this polynya from the east, but from 91.2° E to 93.8° E only loose pack (typical ice concentration of 25 % to 65 %) separates the open ocean from the polynya.

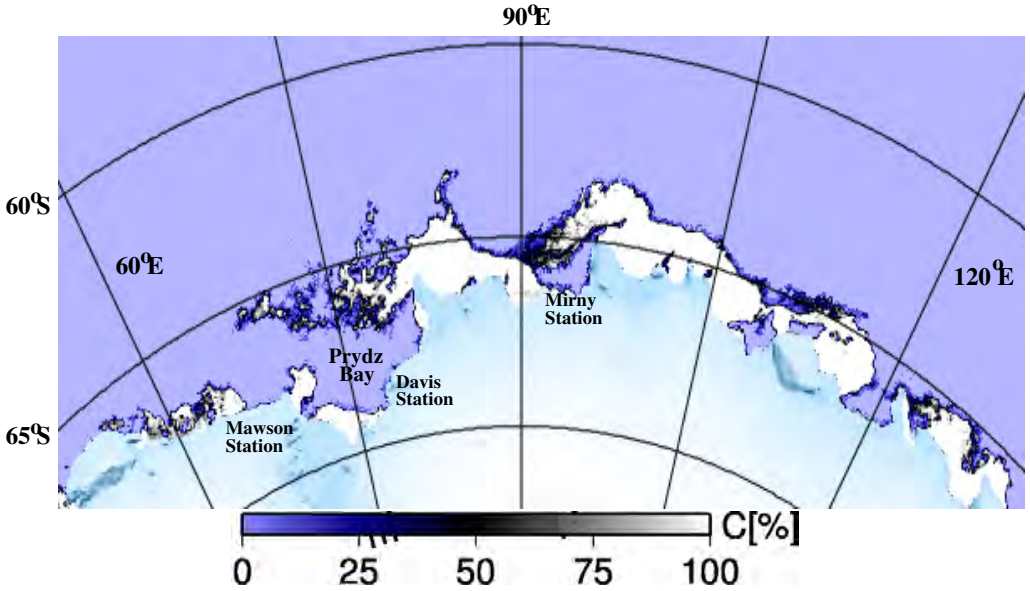

Figure 1: Sea-ice concentration off East Antarctica (07/01/2016, AMSR-2 (ASI) 5.2. Image courtesy Bremen University).

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From 83.2° E to 85.2° E, a persistent filament of sea ice protrudes as far north as 63.25° S with compact sea ice south of 64.5° S in the nearby area. This is the general region of K-Axis waypoints WP0402, WP0403 and nearby unnamed waypoints. Features as this filament are expected to erode as the ice edge retreats towards the Antarctic continent.

- **Mawson Station**
  The fast ice off Mawson Station continued to retreat towards the coast (Figure 2), with the shortest distance from Mawson Station to the northern fast-ice edge at about 6 nautical miles on 08/01/2016 (as derived from MODIS imagery from Terra, courtesy of NASA). During the last 36 hours, bands of unconsolidated pack ice have moved past the northern fast-ice edge.

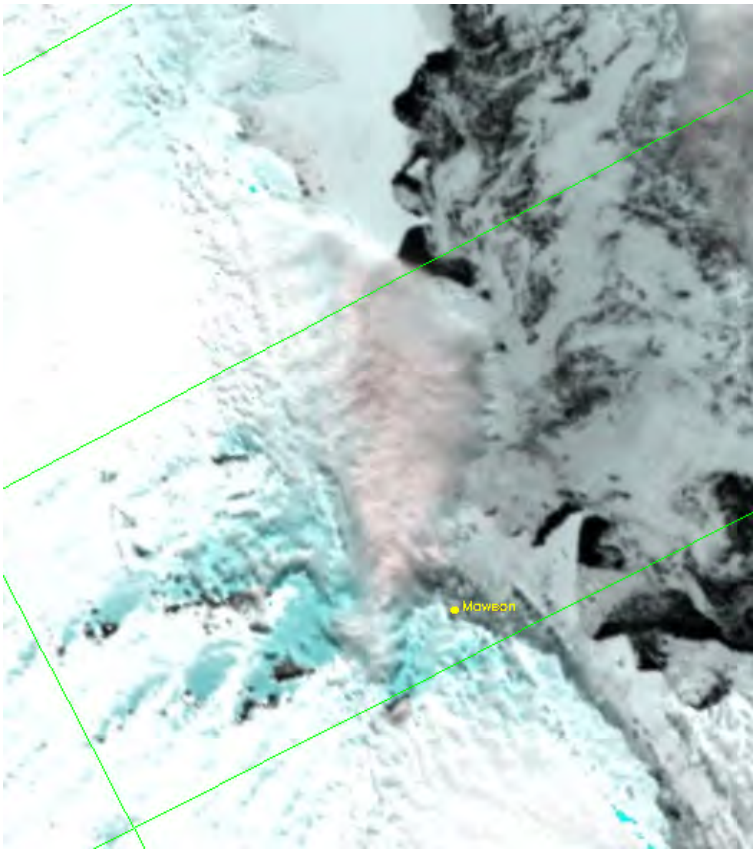

Figure 2: Sea-ice and fast-ice distribution off Mackenzie Coast (04/01/2016, MODIS Aqua image courtesy NASA). Note partial cloud cover affecting the image.

With best regards,

Petra.

Sea Ice Report #03.1/2016

by the Antarctic Gateway Partnership Sea Ice Service*

11/01/2016

This report updates on sea-ice conditions for selected regions of East Antarctica.

- **Maswon Station**
  Figures 1 and 2 show the same geographical frame, offshore Mawson Station, as seen by Landsat-8 visible channels on 08/01/16 and Sentinel-1a SAR on 09/01/16, respectively. The dashed white line denotes a typical approach of RSV *Aurora Australis* into Horseshoe Harbour at Mawson Station. Two very large sea-ice floes (each about 2.5 km long) are circled in both figures. Between the two acquisitions, these two floes have travelled roughly 6.5 nautical miles southwestward.

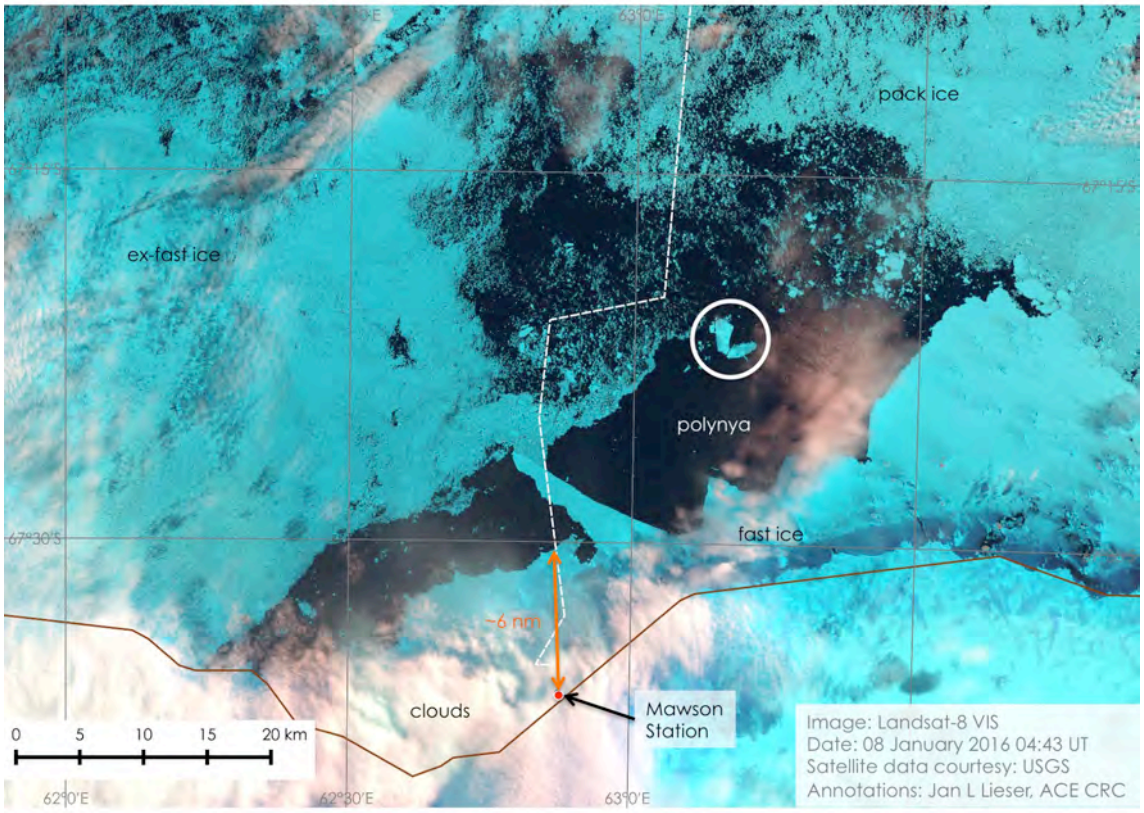

Figure 1: Landsat-8 VIS scene, acquired 08/01/2016 and provided by USGS.

Generally, the fast ice continues to break up in the area and the sea ice is still thinning.

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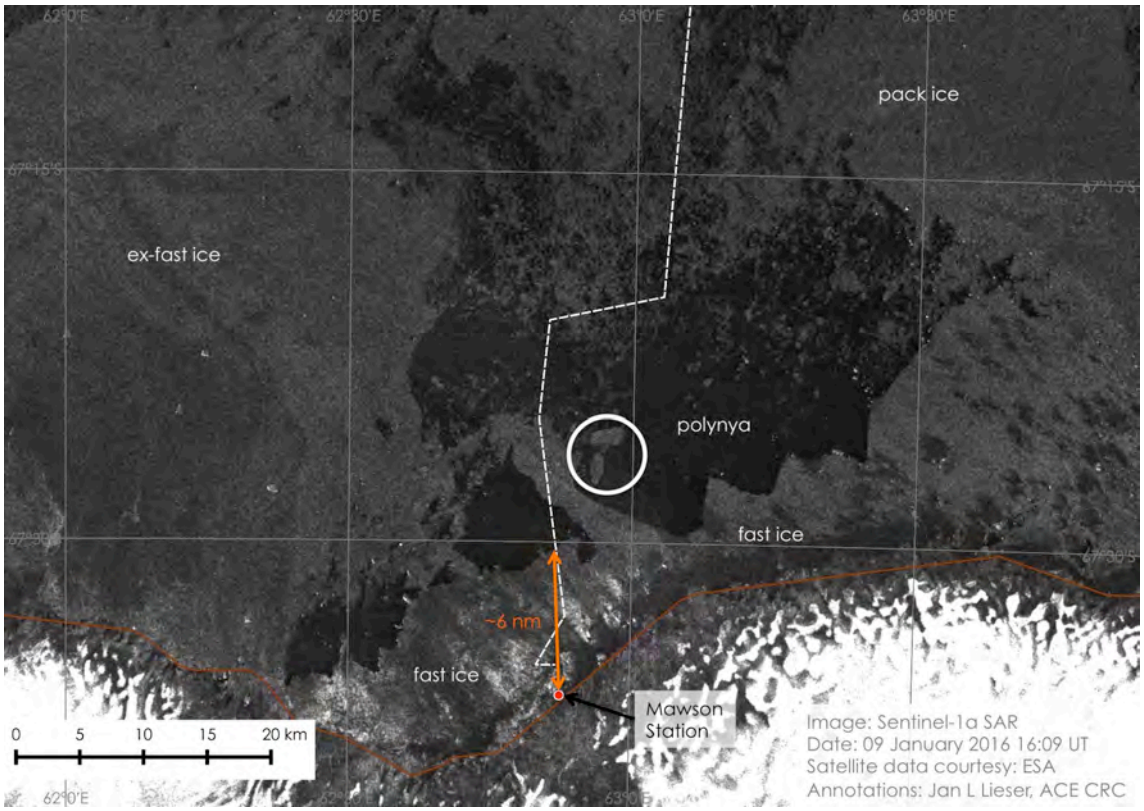

Figure 2: Sentinel-1a SAR scene, acquired 09/01/2016 and provided by ESA.

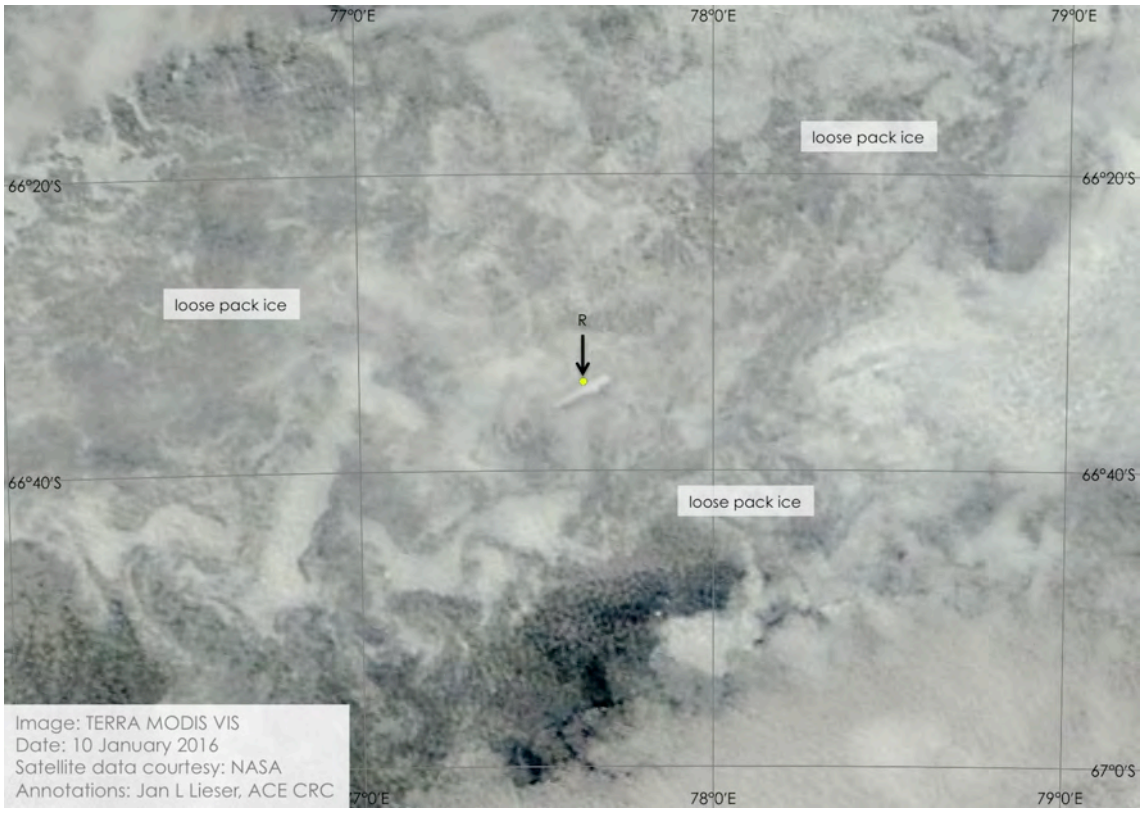

Figure 3: TERRA MODIS VIS scene, acquired 10/01/2016 and provided by NASA.

- **Davis Station**
  North of Davis Station, sea ice is thinning and breaking up into small floes. The location of a 'whale-mooring' (to be recovered) is indicated by a yellow dot in Figure 3. The scene is slightly obscured by thin clouds but the strips and patchy structure of sea ice can clearly be seen.

- **Sabrina Coast**
  Figure 4 shows a SAR scene of the Totten Glacier/Dalton Iceberg Tongue region, offshore Sabrina Coast. Fast ice is retreating largely not only north of the Totten Glacier exposing about half the front of the glacier to the polynya, but also at the northern edge of the Dalton Iceberg Tongue.

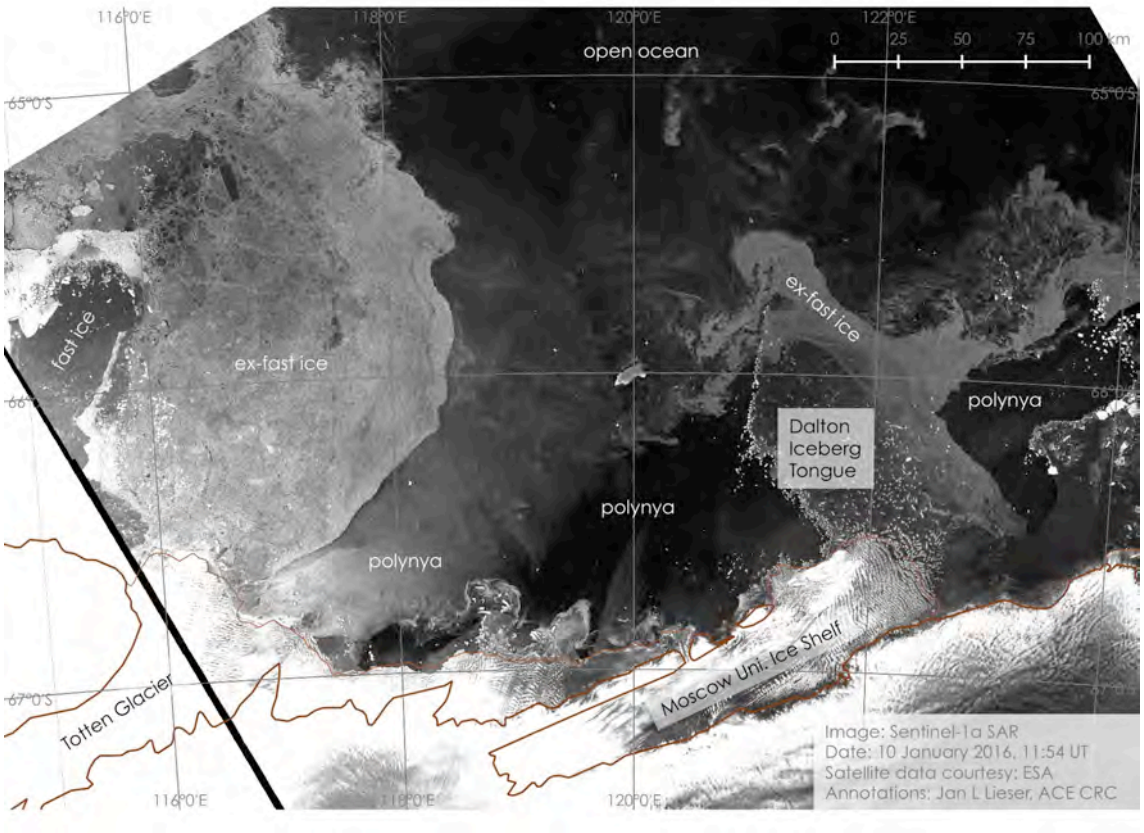

Figure 4: Sentinel-1a SAR scene, acquired 10/01/2016 and provided by ESA.

- **Commonwealth Bay**
  Figure 5 shows a visible scene, offshore Terre Adélie. Between Française Glacier and Commonwealth Bay, the Antarctic coast is exposed to the Southern Ocean and the fast ice in Commonwealth Bay is showing minor signs of break up, at its western edge.

  Iceberg B-9B is still moving very slightly, as is C-15. Iceberg B-9I is drifting freely. Recently added to the list of tracked icebergs are B-39, which is not grounded, and C-29, which was annotated 'large iceberg' in previous Sea Ice Reports.

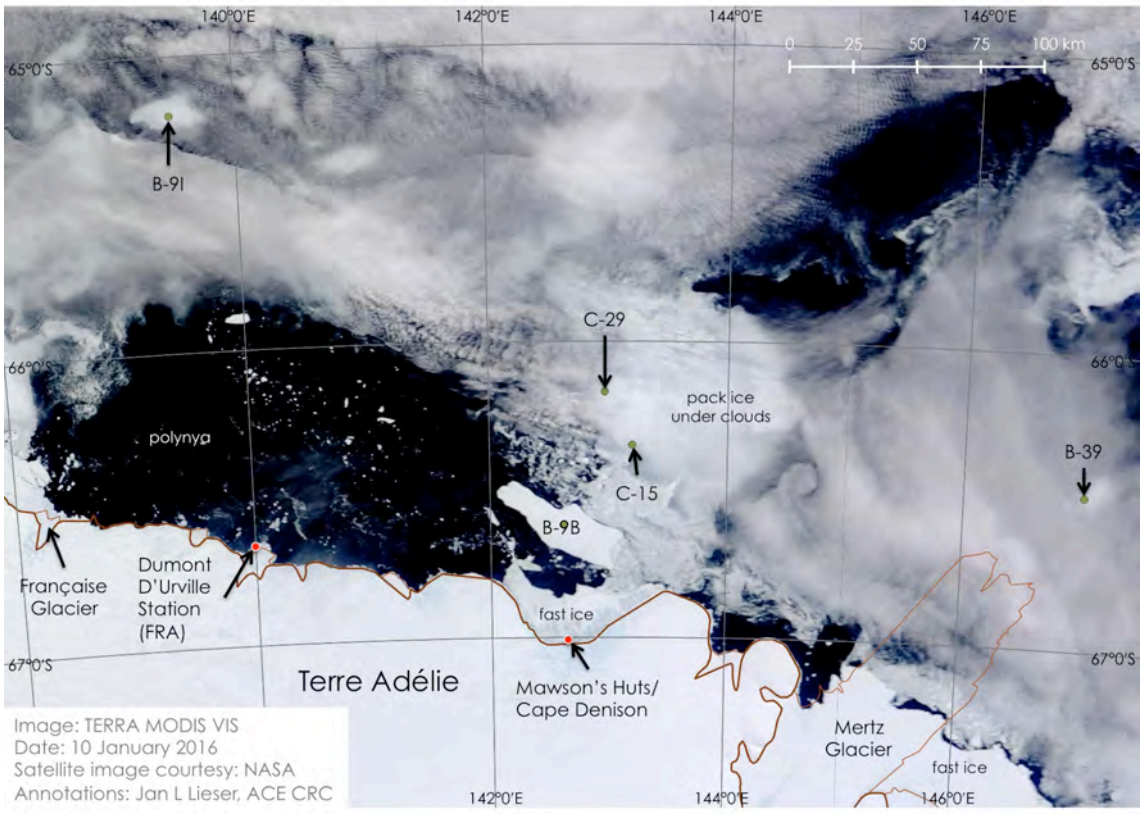

Figure 5: TERRA MODIS VIS scene, acquired 10/01/2016 and provided by NASA.

With best regards,

Jan.

Sea Ice Report #03.2/2016

by the Antarctic Gateway Partnership Sea Ice Service*

14/01/2016

- **K-Axis Region**
  An overview of sea-ice concentration ahead of RSV *Aurora Australis'* marine science voyage is provided with Figure 1. The dashed orange line denotes the proposed cruise track.

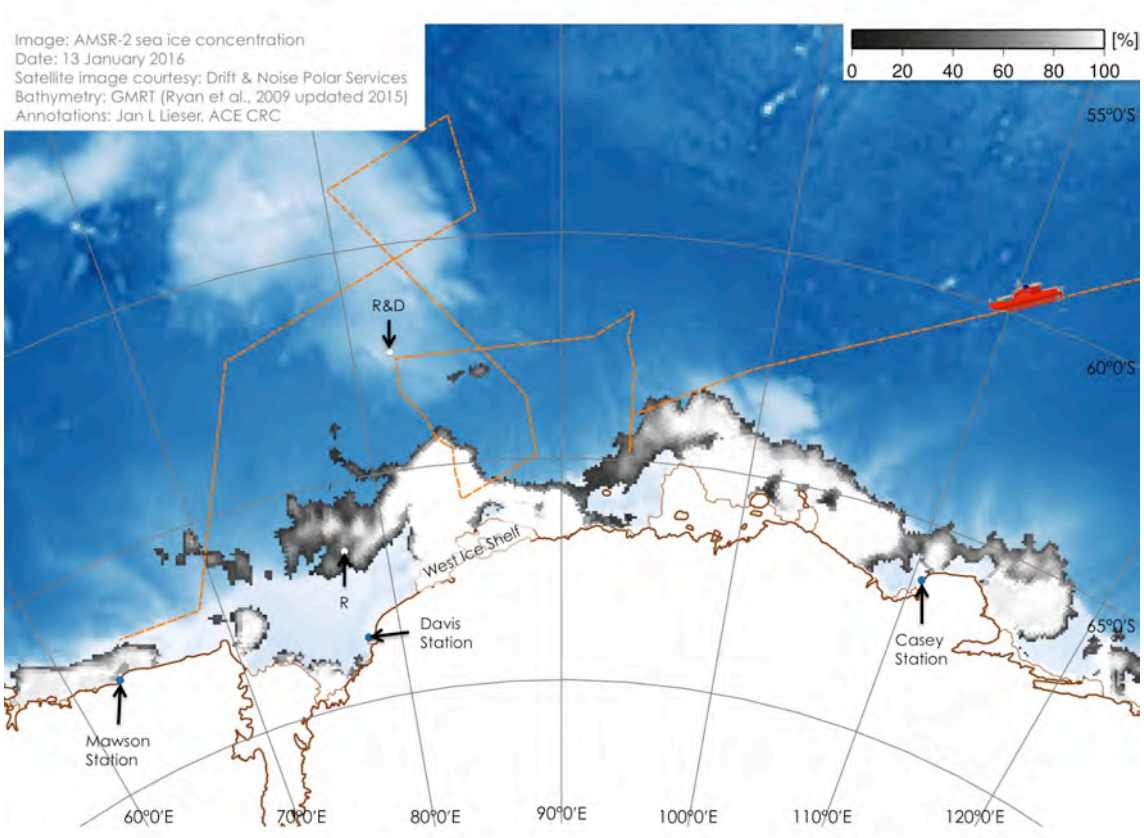

Figure 1: Sea-ice concentration chart, acquired 13/01/2016 and provided by Drift & Noise Polar Services.

Most of the region of interest is free of sea ice, except for two regions between 80° E and 100° E. The southern end of a transect along 93° 30' E leads into approximately 40% of sea-ice concentration, currently. North of the West Ice Shelf remains a field of high concentration sea ice consisting of a mixture of old fast ice and multi year pack ice. The way-points WP0405 to WP0409 are located in 100% sea ice. Way-points WP0403 and WP0404 are currently within the northern marginal edge of that field of sea ice.

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- **Mawson Sation**
  Off Mawson Station, fast ice distribution remains largely unchanged. North of the local fast ice, some pack ice has drifted southward but between 62° E and 64° E, the general tendency of sea ice break-up and melt is maintained.

- **Davis Station**
  Off Davis Station, sea ice has all but gone. Figure 2 shows a high resolution visible image of the Vestfold Hills. Only minimal fast ice remains between the offshore islands and Davis Station. A large tabular iceberg is still grounded roughly 18 km west of the station.

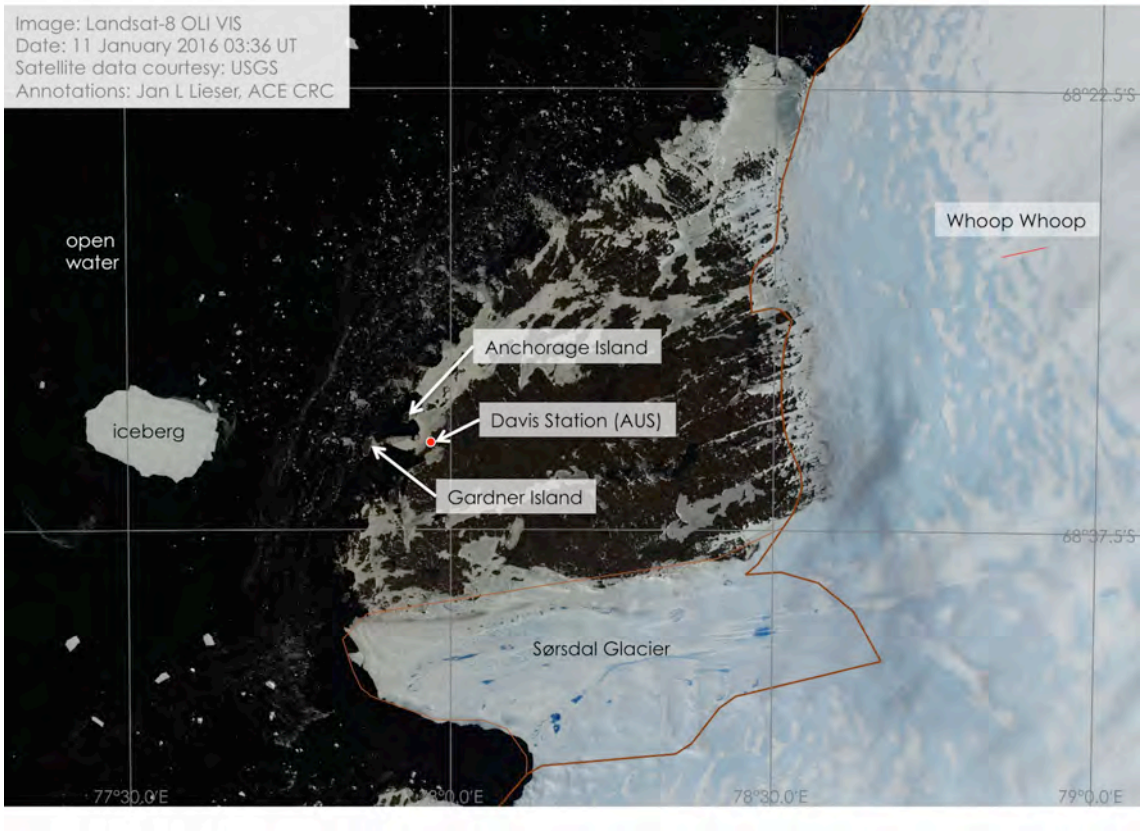

Figure 2: Landsat-8 VIS scene, acquired 11/01/2016 and provided by USGS.

- **Commonwealth Bay**
  Figure 3 shows a high-resolution visible scene, off Cape Denison. The thin red line denotes the edge of fast ice that did not break out at the end of the previous summer, in March 2015 (see Sea Ice Report #12.2/2015).

  At the northern edge of the fast ice of Commonwealth Bay, minor pieces of fast ice are breaking up and floating off. Close to the shoreline, tide cracks are detectible in the image, particularly in the western part of the bay at 142° 21' 17" E and 66° 57' 32" S and elsewhere in this first-year fast ice.

Iceberg C-15 is generally travelling northward but the other two icebergs visible in the figure remain local.

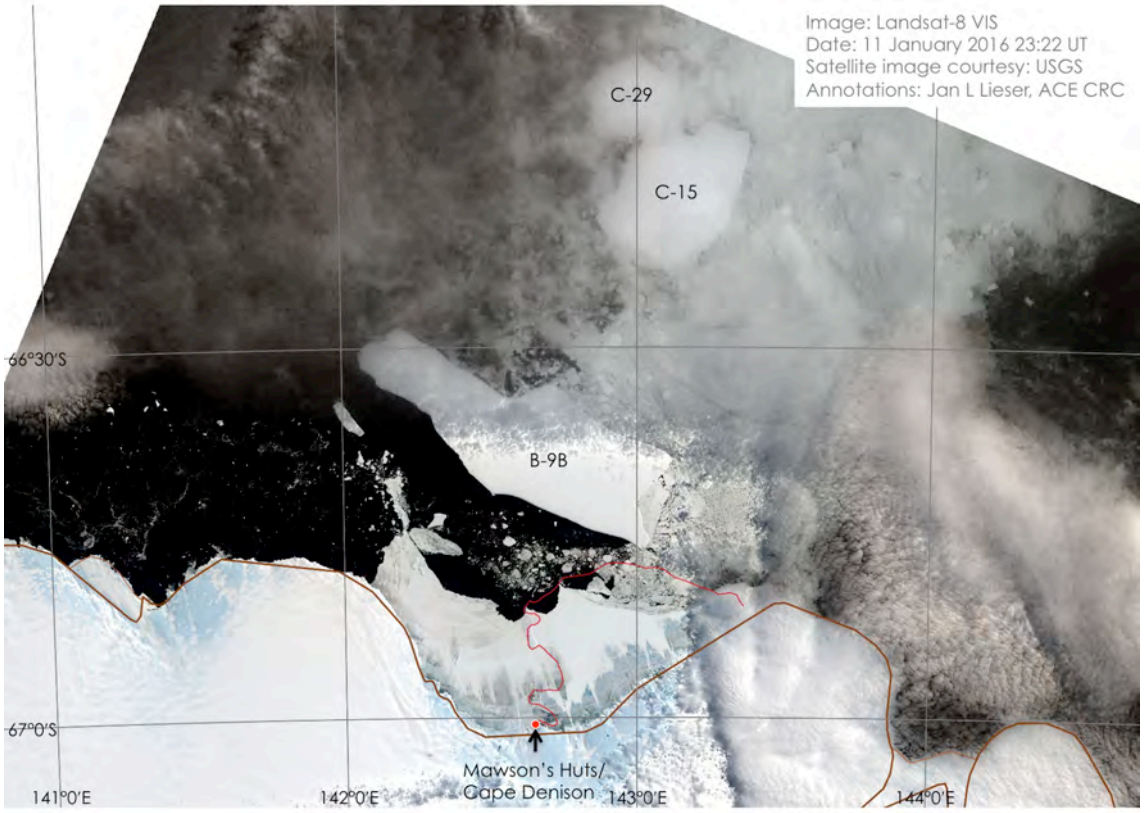

Figure 3: Landsat-8 VIS scene, acquired 11/01/2016 and provided by USGS.

With best regards,

Jan.

Sea Ice Report #03.3/2016

by the Antarctic Gateway Partnership Sea Ice Service*

15/01/2016

This report updates on the rift across iceberg D-15.

- **D-15**
  North of the West Ice Shelf, iceberg D-15 is grounded. Last winter, a rift appeared cutting through the southwestern part of the berg (see Sea Ice Report #33.1/2015). The size of the splitting part of the berg is roughly 1260 km^2, only slightly smaller than Flinders Island (Tasmania). In October 2015, the northern part of the rift was about 800 m across (Sea Ice Report #43.1/2015) but has now widened to more than 1 km and patches of open water can be identified in the visible image of Figure 1.

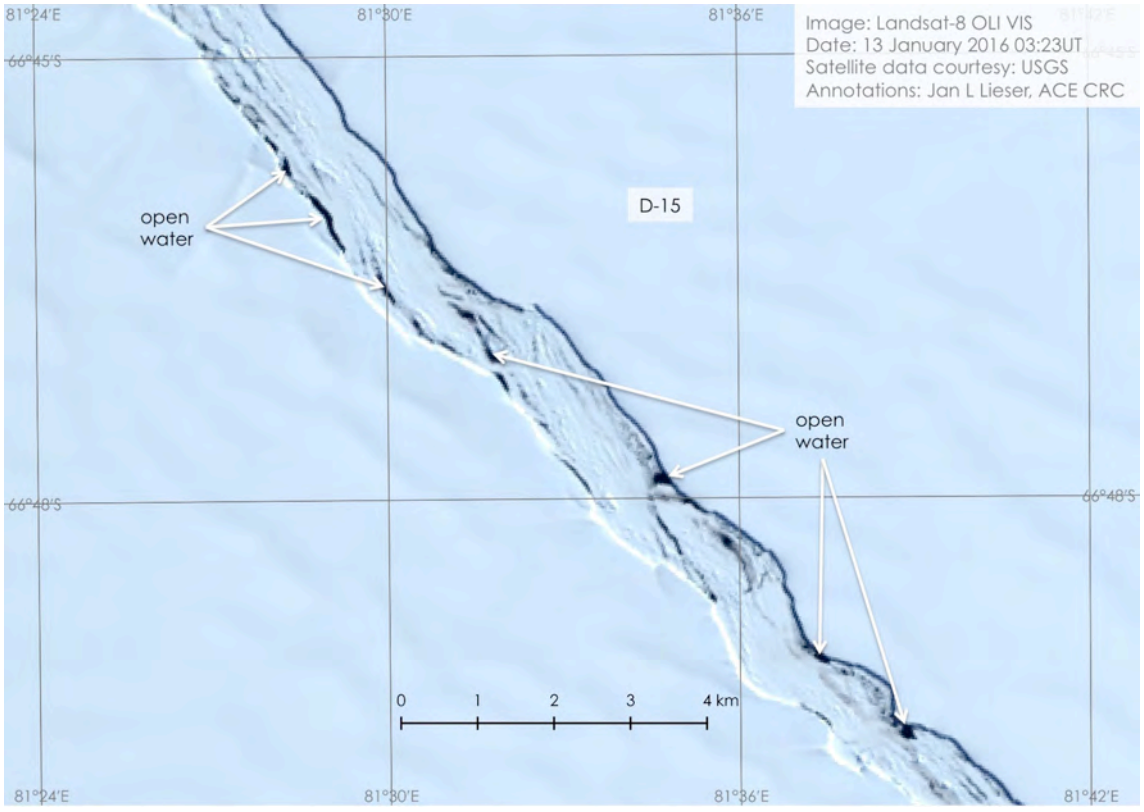

Figure 1: Landsat-8 VIS scene, acquired 13/01/2016 and provided by USGS.

The location of the detail of Figure 1 is indicated by the dashed frame in Figure 2. Figures 2 and 3 also show that an inlet at the northern tip of the splitting piece is deepening (recently by about 5 km) and another rift forming at the western flank of the piece.

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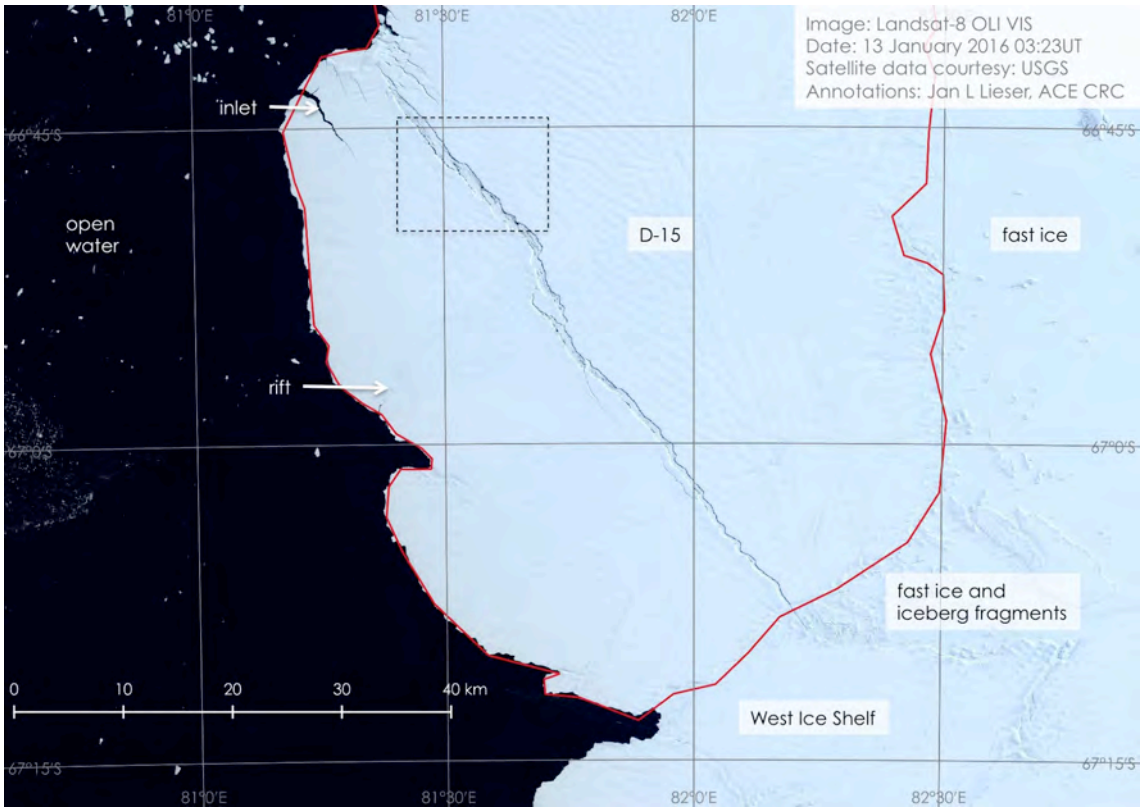

Figure 2: Landsat-8 VIS scene, acquired 13/01/2016 and provided by USGS.

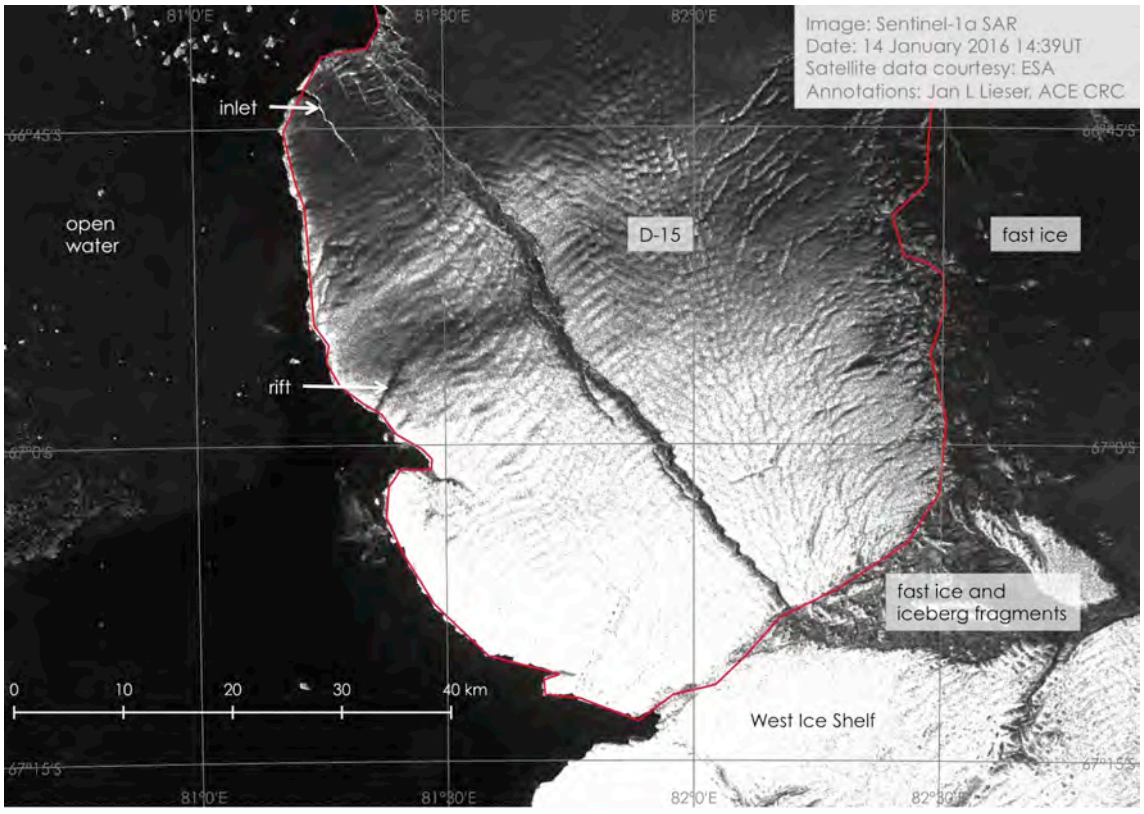

Figure 3: Sentinel-1a SAR scene, acquired 14/01/2016 and provided by ESA.

While the northern part of the rift shows signs of weakening and the rift's southern end extents into the multi-year fast ice wedged between the West Ice Shelf and D-15, the central part of the splitting piece of D-15 still rests against the northern edge of the West Ice Shelf.

With best regards,

Jan.

Sea Ice Report #04.1/2016

by the Antarctic Gateway Partnership Sea Ice Service*

18/01/2016

- **Mawson Station**
  Figure 1 shows a high-resolution visible image of the fast ice, off Mawson Station. The fast-ice edge is slowly retreating southward. The colour of the ice surface suggests that there is no substantial snow cover present and some darker patches near the coast and between islands indicated thinning of the ice cover.

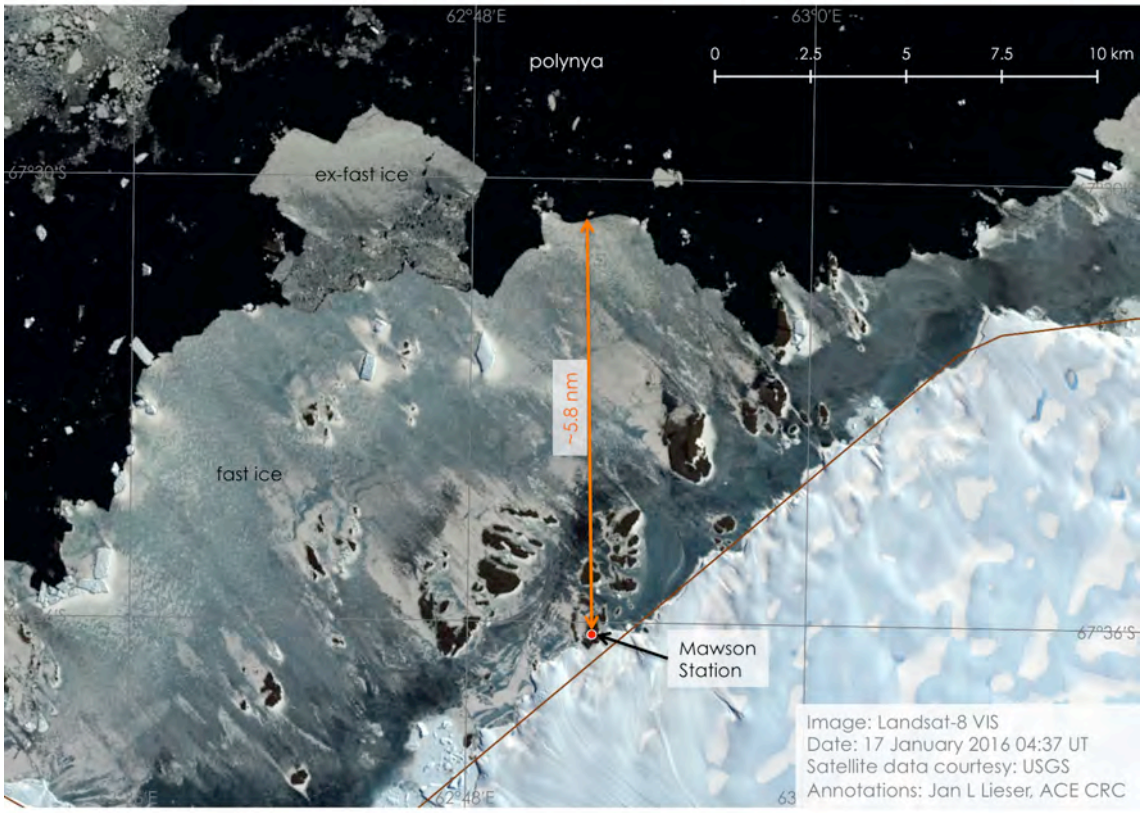

Figure 1: Landsat-8 VIS scene, acquired 17/01/2016 and provided by USGS.

The location of the detail of Figure 1 is indicated by the dashed frame in Figure 2. Figure 2 provides an overview of the entire sea-ice zone north of Mawson Station. Only the southern end of 'iceberg alley' holds some decaying sea ice and the pack ice between the open ocean in the north and the polynya off the station consists predominantly of small floes of ex-fast ice. The coastal fast ice east and west of Mawson Station shows also further signs of retreat.

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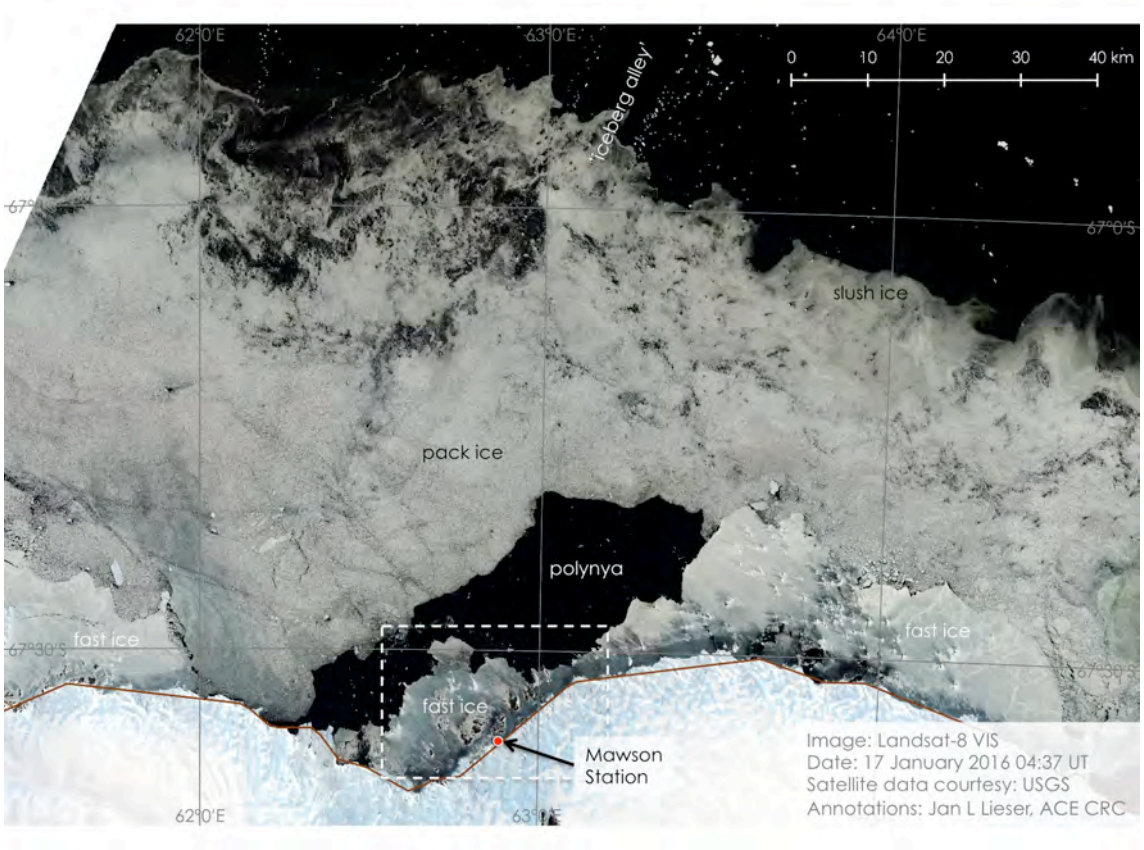

Figure 2: Landsat-8 VIS scene, acquired 17/01/2016 and provided by USGS.

With best regards,

Jan.

Sea Ice Report #04.2/2016

by the Antarctic Gateway Partnership Sea Ice Service*

21/01/2016

- **K-Axis Region**
  Figure 1 shows an overview of sea-ice concentration in the region of RSV *Aurora Australis*' current marine science voyage. The white dashed line denotes the proposed cruise plan, the orange line the actual track (up until 21/01/16 00:00 UT). The locations of two 'whale moorings' are marked with white dots and annotated 'R' and 'R&D'.

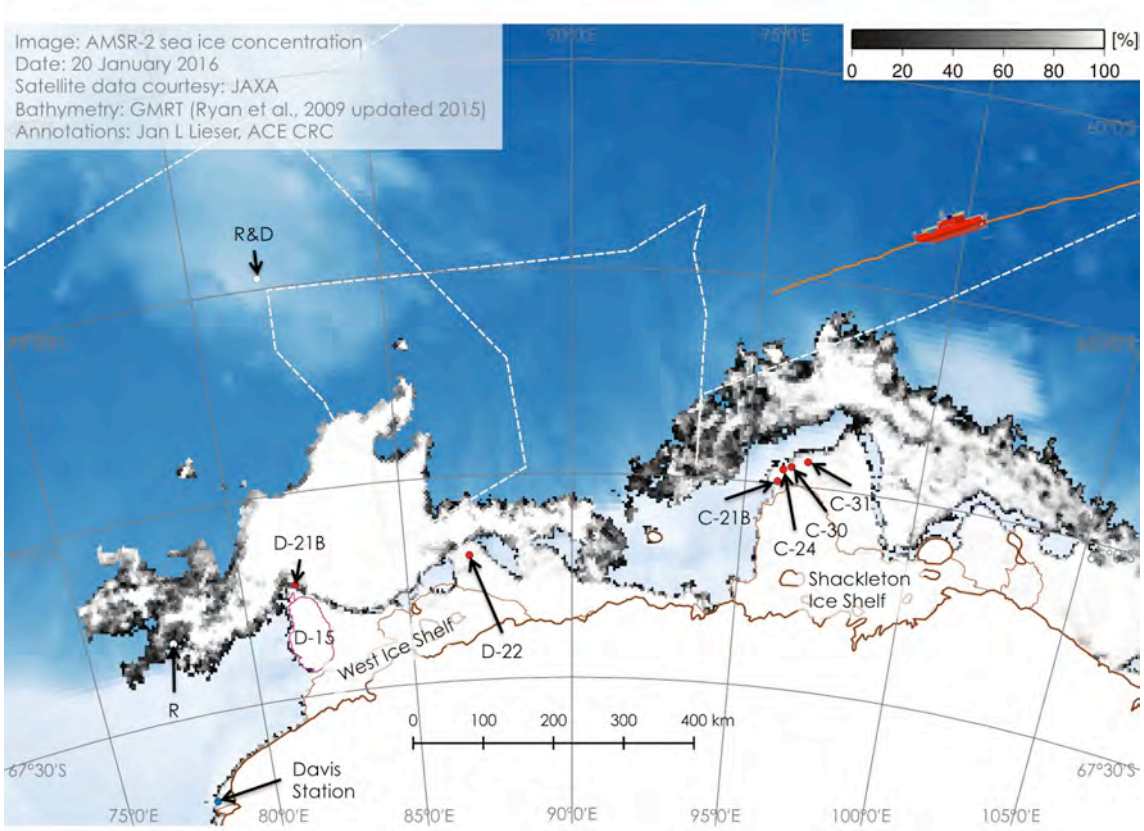

Figure 1: AMSR-2 sea-ice concentration, acquired 20/01/2016 and provided by Universität Hamburg.

The southern end of a proposed north-south transect along 93° 30' E leads into an area of patchy sea-ice concentration, but typically less than 60%. North of the West Ice Shelf is still a field of very high (100%) sea-ice concentration consisting of a mixture of old fast ice and multi-year pack ice. The way-points WP0403 to WP0409 are located in up to 100% sea ice.

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- **Mawson Station**
  Off Mawson Station, fast ice continues to retreat slowly. Some Antarctic coast is now exposed to the polynya, at 62° 27' E and 63° 07' E.

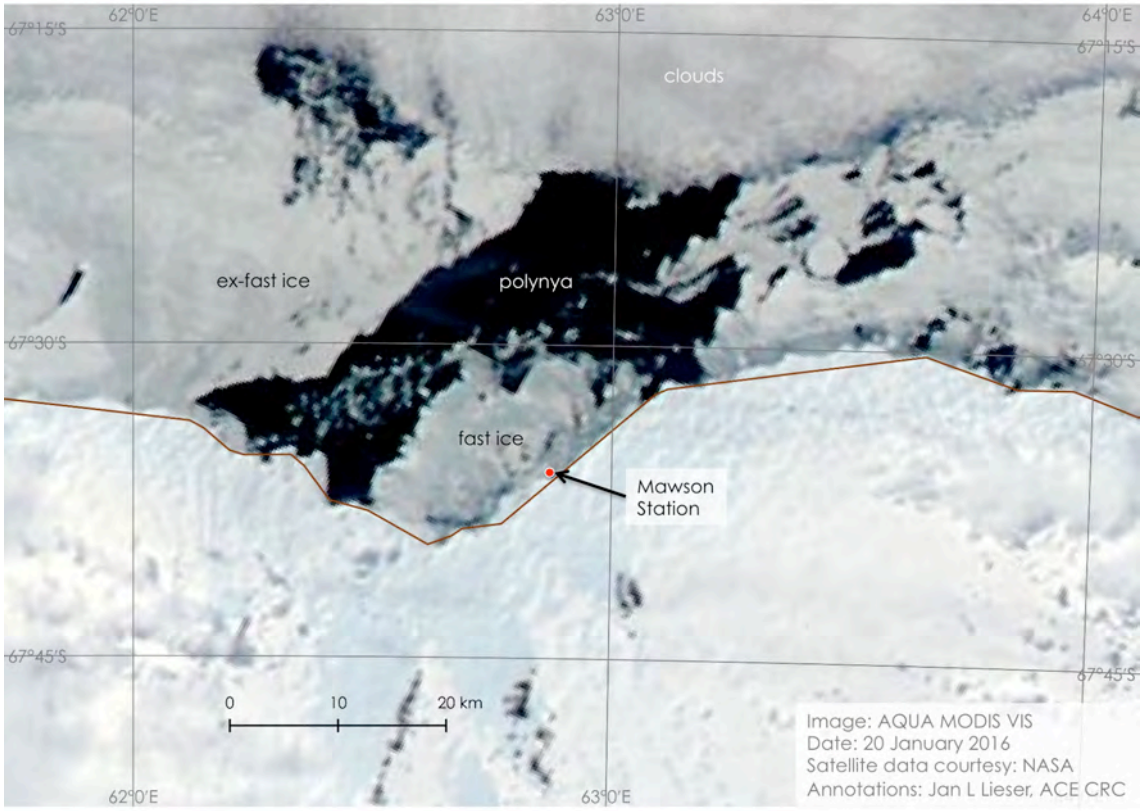

Figure 2: MODIS VIS scene, acquired 20/01/2016 and provided by NASA.

With best regards,

Jan.

Sea Ice Report #05.1/2016

by the Antarctic Gateway Partnership Sea Ice Service*

25/01/2016

- **K-Axis Region**
  Figure 1 shows an overview of sea-ice concentration in the region of RSV *Aurora Australis*' current marine science voyage. The white dashed line denotes the proposed cruise plan, the orange line the actual track (up until 25/01/16 00:00 UT). The locations of two 'whale moorings' are marked with white dots and annotated 'R' and 'R&D'.

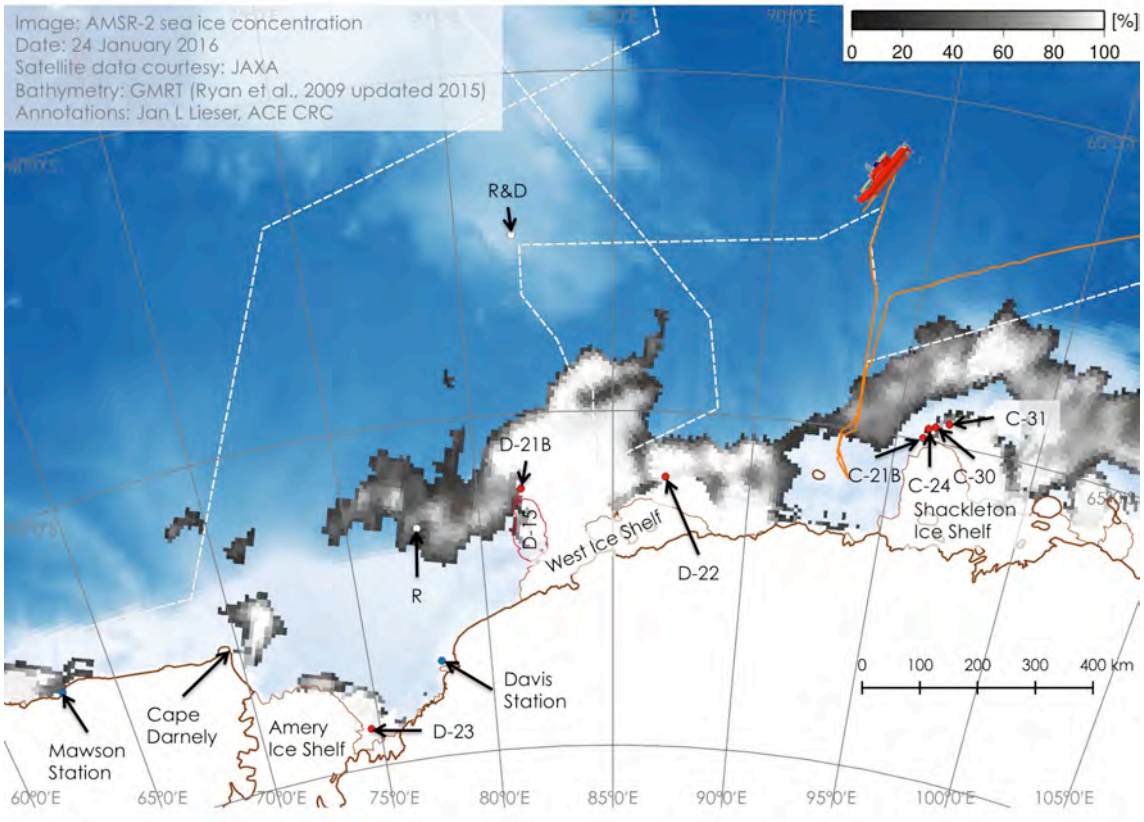

Figure 1: AMSR-2 sea-ice concentration, acquired 24/01/2016 and provided by Drift & Noise Polar Services.

The overall sea-ice conditions have not changed significantly, during the last couple of days in the region of operations. North of the West Ice Shelf, the mixture of old fast ice and multi-year pack ice remains at very high concentrations.

North of Davis Station, the location of the 'retrieve only' whale mooring (marked 'R') is covered by roughly 30% sea-ice concentration.

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- **Prydz Bay**
  Off Mawson Station and in the southern Prydz Bay (Figure 2), fast ice continues to retreat steadily. At Mawson Station, the length of Antarctic coast exposed to the polynya in increasing. Figure 2 shows the fast ice east of Cape Darnley breaking up and the northern side of the Larsemann Hills (home of Zhongshan, Progress and Bharati stations) free of fast ice now.

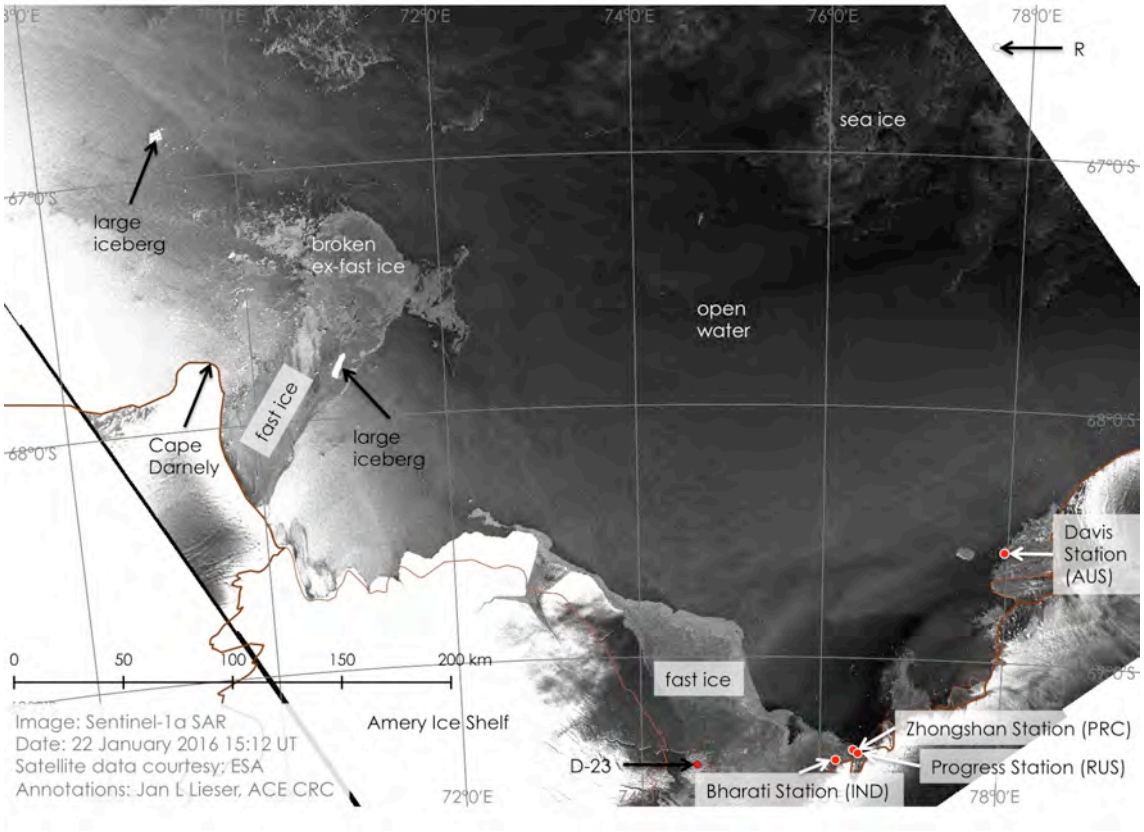

Figure 2: Sentinel-1a SAR scene, acquired 22/01/2016 and provided by ESA.

The location of the 'retrieve only' whale mooring (marked 'R', see previous section) is just outside the SAR swath in the north-eastern corner of the figure.

With best regards,

Jan.

Sea Ice Report #05.2/2016

by the Antarctic Gateway Partnership Sea Ice Service*

28/01/2016

- **K-Axis Region**
  Figure 1 shows an overview of sea-ice concentration in the region of RSV *Aurora Australis*' current marine science voyage. The white dashed line denotes the proposed cruise plan, the orange line the actual track (up until 28/01/16 00:00 UT). The locations of two 'whale moorings' are marked with white dots and annotated 'R' and 'R&D'.

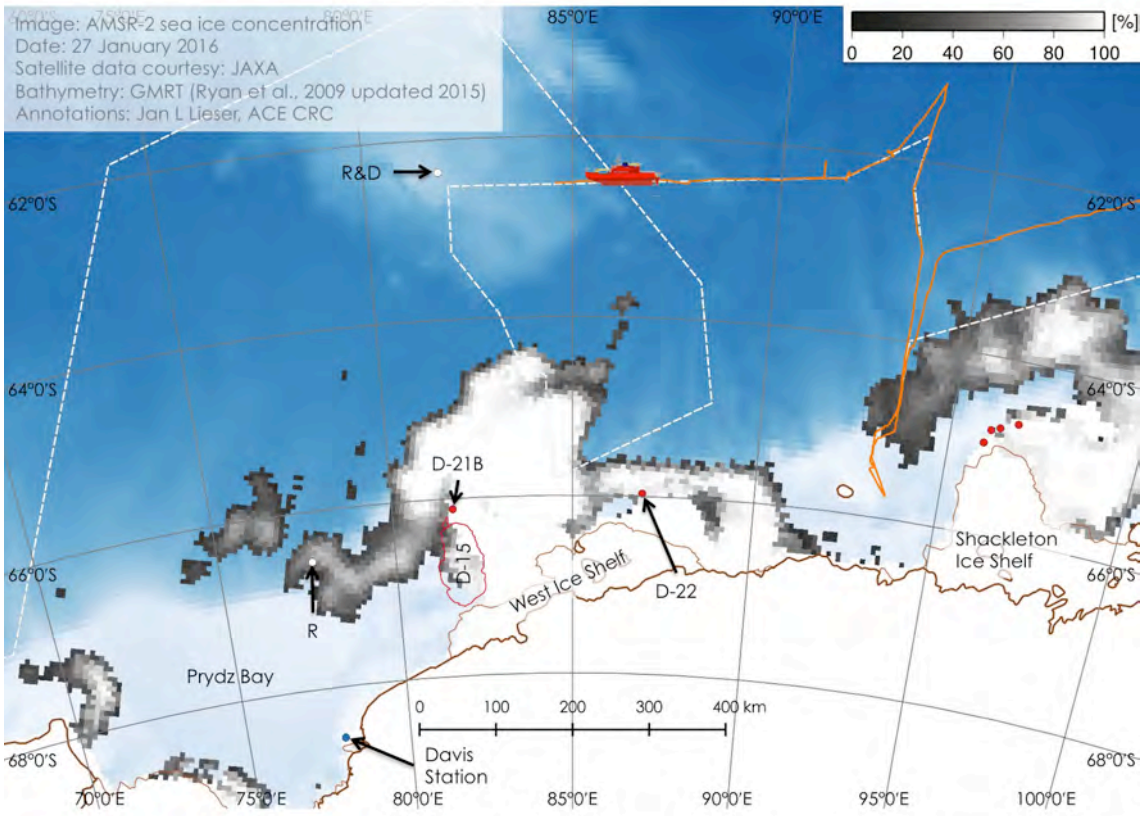

Figure 1: AMSR-2 sea-ice concentration, acquired 27/01/2016 and provided by Drift & Noise Polar Services.

North of the West Ice Shelf, sea-ice extent is slightly decreasing at the northern margin, however the proposed waypoints WP0403 to WP0409 remain within 100% sea-ice concentration.

North of Davis Station, the location of the 'retrieve only' whale mooring (marked 'R') is covered by very open sea ice (see Figure 3).

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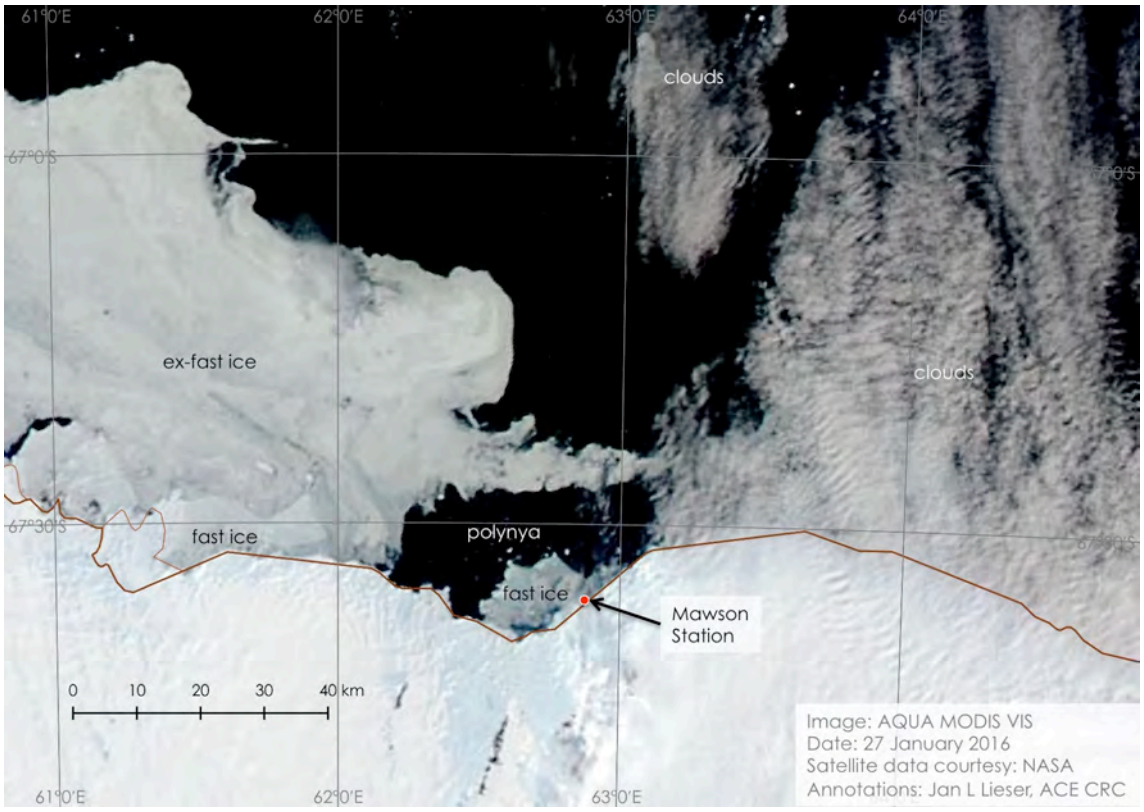

Figure 2: MODIS VIS scene, acquired 27/01/2016 and provided by NASA.

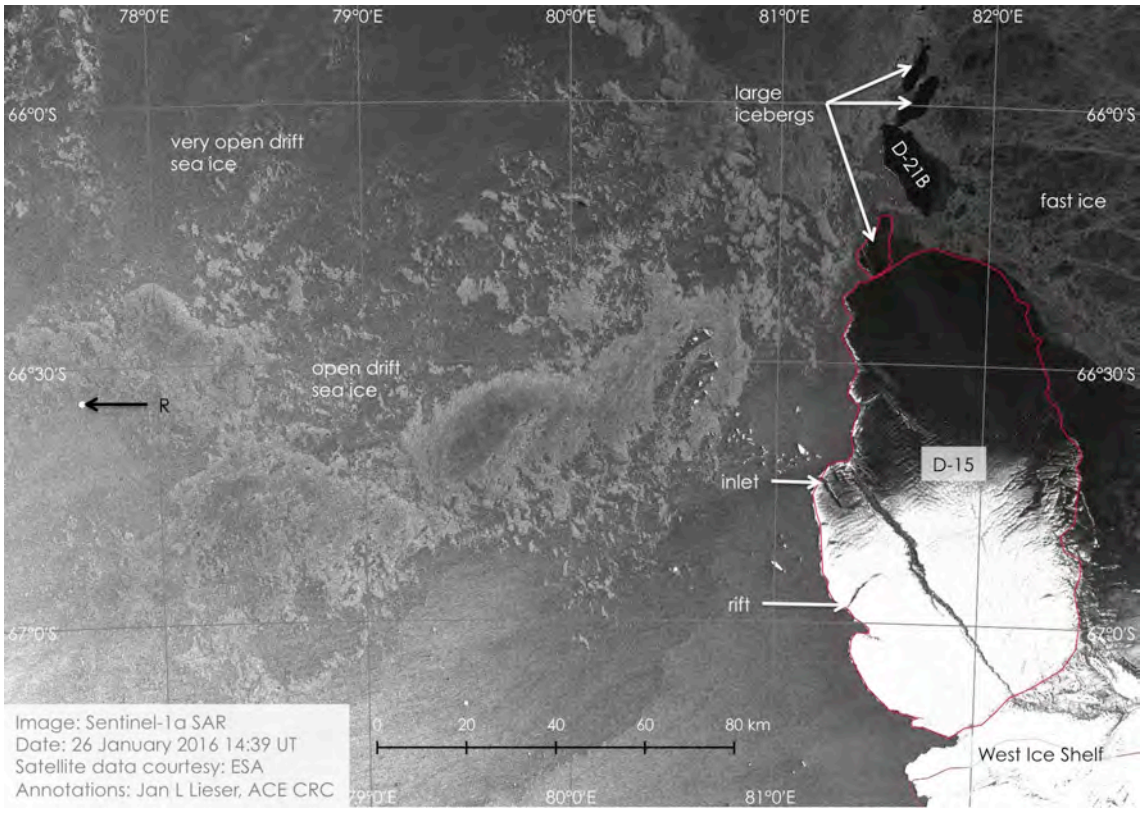

Figure 3: Sentinel-1a SAR scene, acquired 26/01/2016 and provided by ESA.

- **Mawson Station**
  Off Mawson Station, fast ice continues to retreat slowly. The distance between the station and the northern edge of the fast ice is roughly 1.9 nautical miles. West of the station, a large field of high concentration ex-fast ice is breaking into smaller floes and extends a tongue of broken sea ice eastward, along 67° 24' S (see Figure 2).

- **D-15**
  The major rift splitting a large piece of iceberg D-15 off its southwestern part continues to expand. Since 13/01/2016, the width of this rift has increased to more than 1.5 km, in its northern part (compare Sea Ice Report #03.3/2016). Another rift and inlet (see annotations in Figure 3) became also a little bigger, during the last fortnight.

  As mentioned above, the location of a 'retrieve only' whale mooring (white dot) is currently within open to very open drift ice (less than 50% sea-ice concentration).

With best regards,

Jan.

Sea Ice Report #05.3/2016

by the Antarctic Gateway Partnership Sea Ice Service*

29/01/2016

- **Amundsen Sea & Ross Sea**
  The sea-ice chart provided in Figure 1 gives a large scale overview of conditions in Ross Sea and Amundsen Sea. Red dots mark locations of large tabular icebergs. The current cruise track of RV *Xue Long* is shown as an orange line (up until 29/01/2016 00:00 UT), just entering the region form the east, at about 70° 30' S.

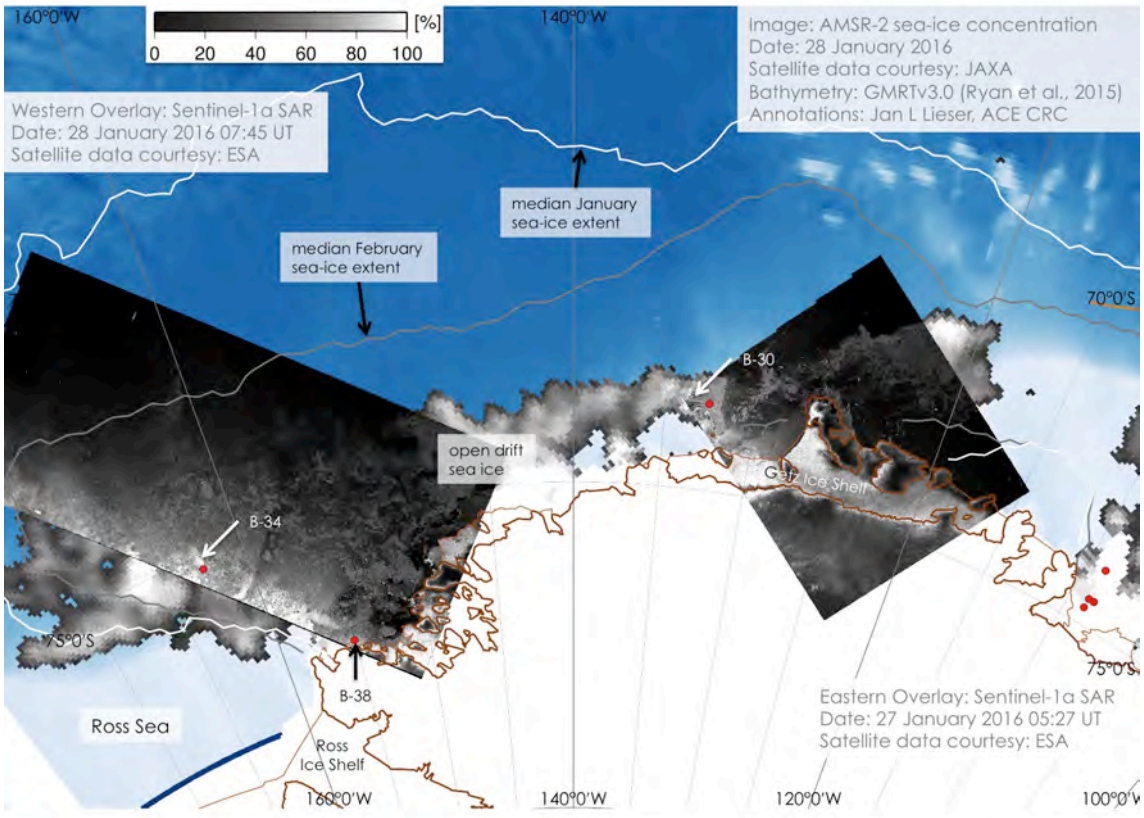

Figure 1: Sea-ice conditions in Ross Sea and Amundsen Sea, data provided by PolarView (SAR) and Drift & Noise Polar Services (AMSR-2).

In the entire region, sea-ice extent is much below (south of) the long-term median extent for January (white line in Figure 1) and with the exception of the western Ross Sea already largely below the median February extent (grey line in Figure 1). Sea-ice concentration is only light to moderate (typically below 60%), close to the coast.

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North of the western side of the Getz Ice Shelf, iceberg B-30 (size: 26 nautical miles × 18 nautical miles) is on the move. Since its last official observation on 22/01/2016 (the red dot), it can now be found roughly 17 nautical miles further west, as evident from MODIS visible imagery from 28/01/2016 (not shown). Similarly, in central Ross Sea, iceberg B-34 (Figure 2; size: 11 nautical miles × 4.5 nautical miles) can now be found about 9 nautical miles further north than on 22/01/2016 (red dot).

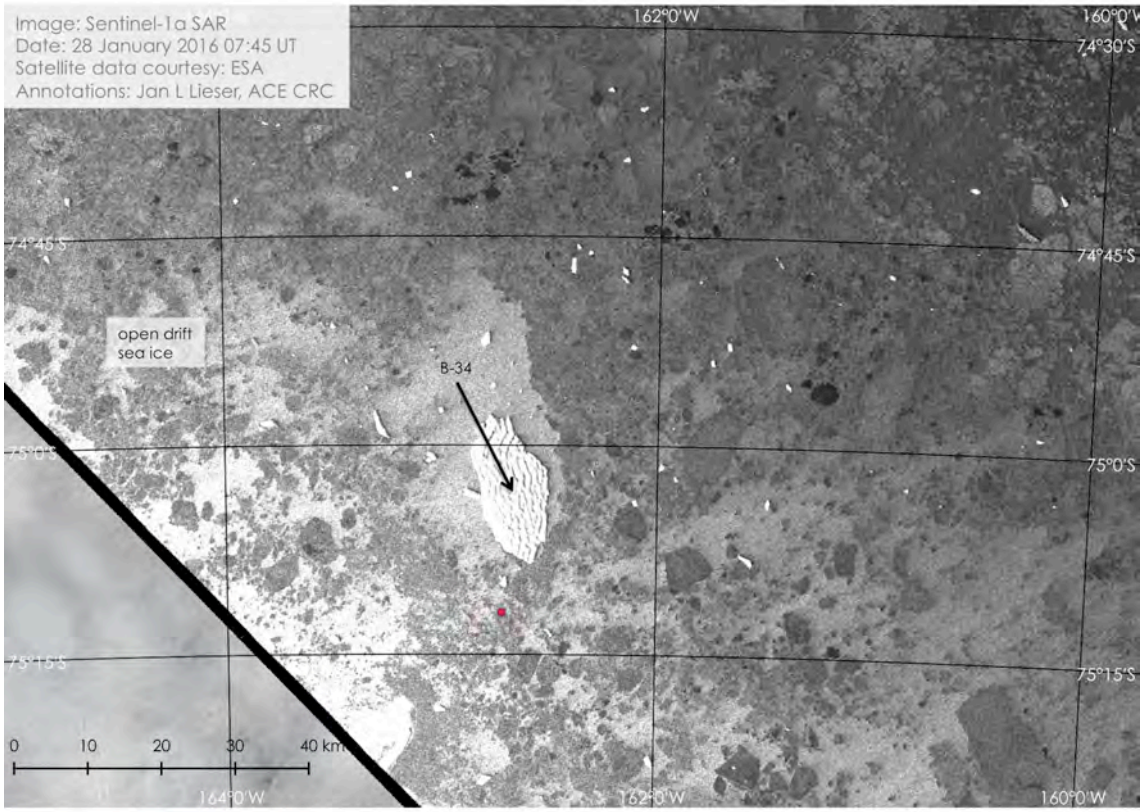

Figure 2: Sentinel-1a SAR scene; acquired 28/01/2016 and provided by PolarView.

B-34 appears to be spawning many small bergs into the surrounding water, as the previously reported size was 15 nautical miles × 5 nautical miles. The smaller bergs can be seen as white fragments, particularly north and east of B-34, in Figure 2.

With best regards,

Jan.

Sea Ice Report #06.1/2016

by the Antarctic Gateway Partnership Sea Ice Service*

01/02/2016

This report updates on sea-ice conditions of selected regions of the Australian Antarctic Territory.

- **K-Axis Region**
  Figure 1 shows a high resolution SAR scene of sea ice in the region of RSV *Aurora Australis*' current marine science voyage. The white dashed line denotes the proposed cruise plan, the orange line the actual track (up until 01/02/16 00:00 UT). The location of a 'whale mooring' is marked with white dot and annotated 'R'. It is covered by very open sea ice (less than 50%).

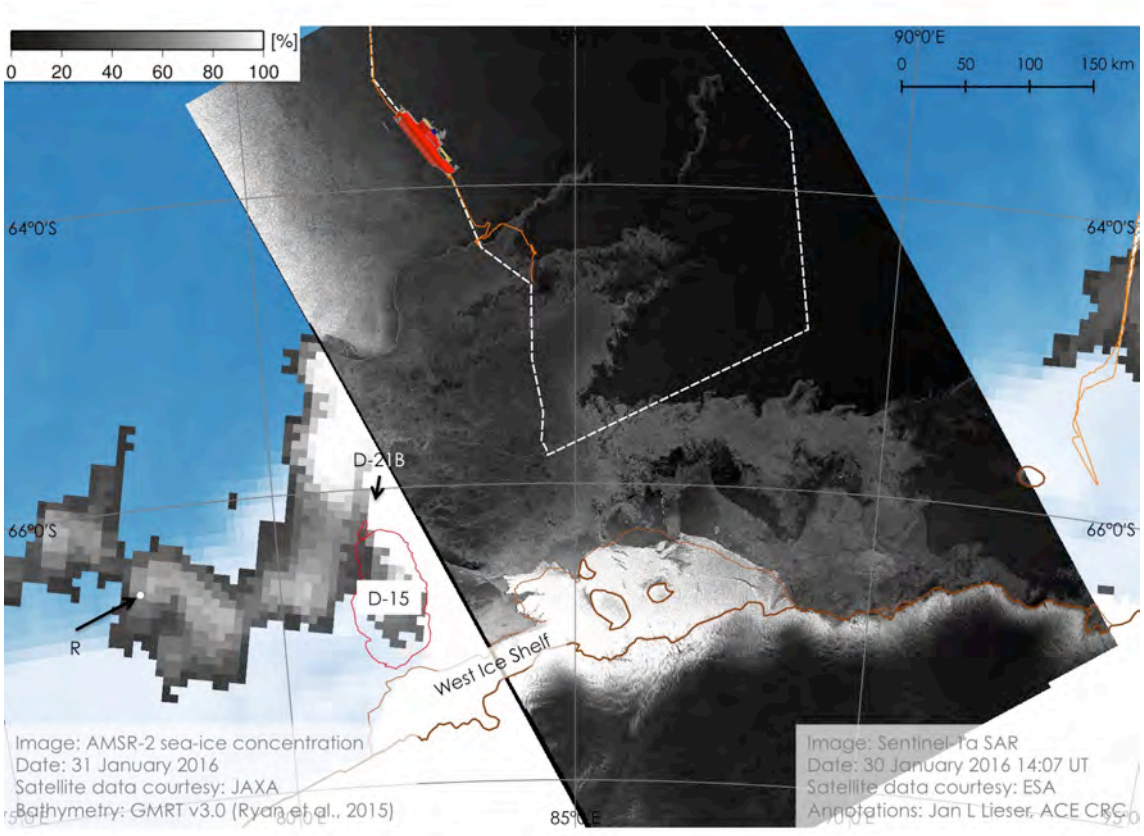

Figure 1: Sentinel-1a SAR scene, acquired 30/01/2016 and provided by PolarView. AMSR-2 sea-ice concentration, acquired 31/01/2016 and provided by Drift & Noise Polar Services.

North of the West Ice Shelf, sea-ice extent is slightly decreasing at the northern margin, and strips and patches of sea ice can be seen

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heading in northeasterly direction. Proposed waypoints WP0405 to WP0409 remain within 100% sea-ice concentration.

- **Mawson Station**
  Off Mawson Station, fast ice has broken out on 30/01/2016 (Figure 2). There is still a large number of icebergs in the region, but the path from 'iceberg alley' into Horseshoe Harbour is free of sea ice, except for the occasional floe drifting across.

  In the RADAR scene of Figure 2, we also note a couple of wave trains, offshore (marked by orange loops), with a typical wavelength of roughly 2 km, an oceanic surface feature.

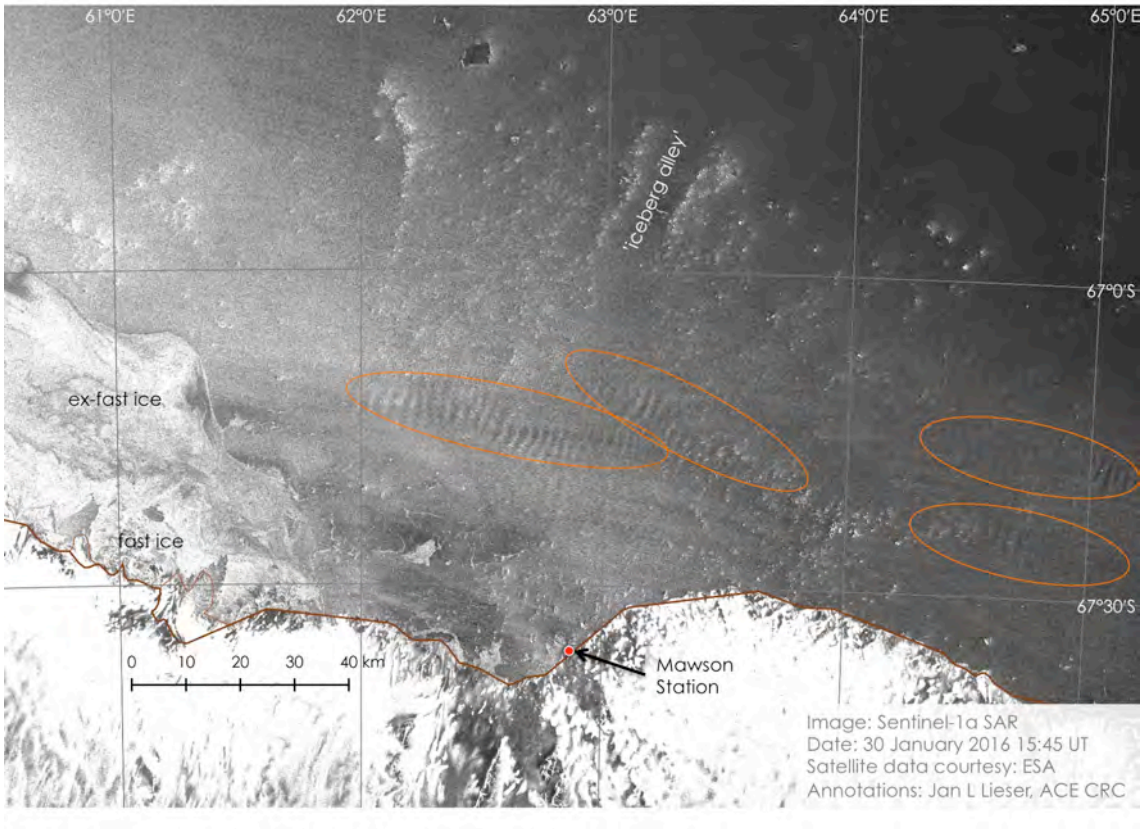

Figure 2: Sentinel-1a SAR scene, acquired 30/01/2016 and provided by PolarView.

- **Sabrina Coast**
  Figure 3 shows a high-resolution SAR scene of Law Dome, complemented by MODIS visible data, covering the Dalton Iceberg Tongue.

  Offshore Sabrina Coast, the polynya is growing and approximately 14 km of coast are exposed to the ocean between Totten and Williamson glaciers.

  Fast ice in between icebergs of the Dalton Iceberg Tongue is breaking up in some areas and can be found drifting in the polynya.

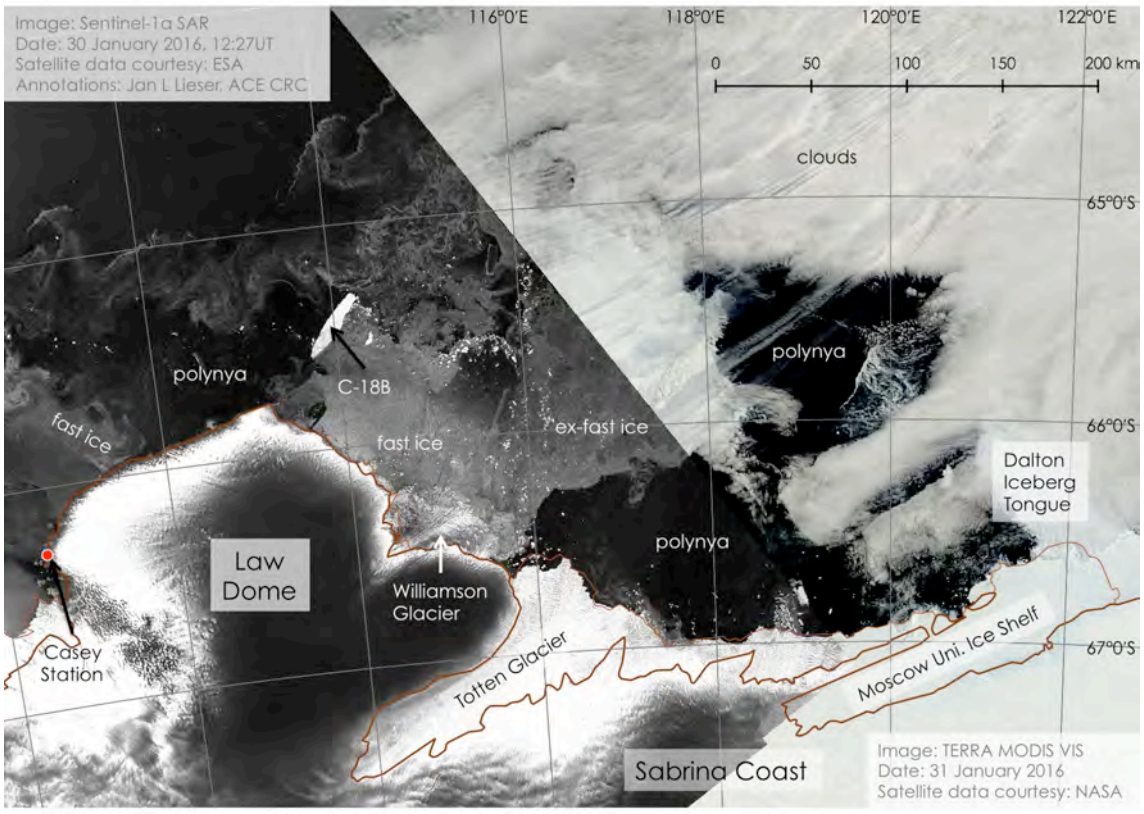

Figure 3: Sentinel-1a SAR scene, acquired 30/01/2016 and provided by PolarView, and MODIS VIS scene, acquired 31/01/2016 and provided by NASA.

With best regards,

Jan.

Sea Ice Report #06.2/2016

by the Antarctic Gateway Partnership Sea Ice Service*

03/02/2016

- **Ross Sea**
  Figure 1 shows a MODIS visible scene of western Ross Sea. The orange scribble line denotes RV *Xue Long*'s current voyage track in the region (up until 03/02/2016 03:00 UT). The white contours give the 15% sea-ice concentration edge, as of 02/02/2016.

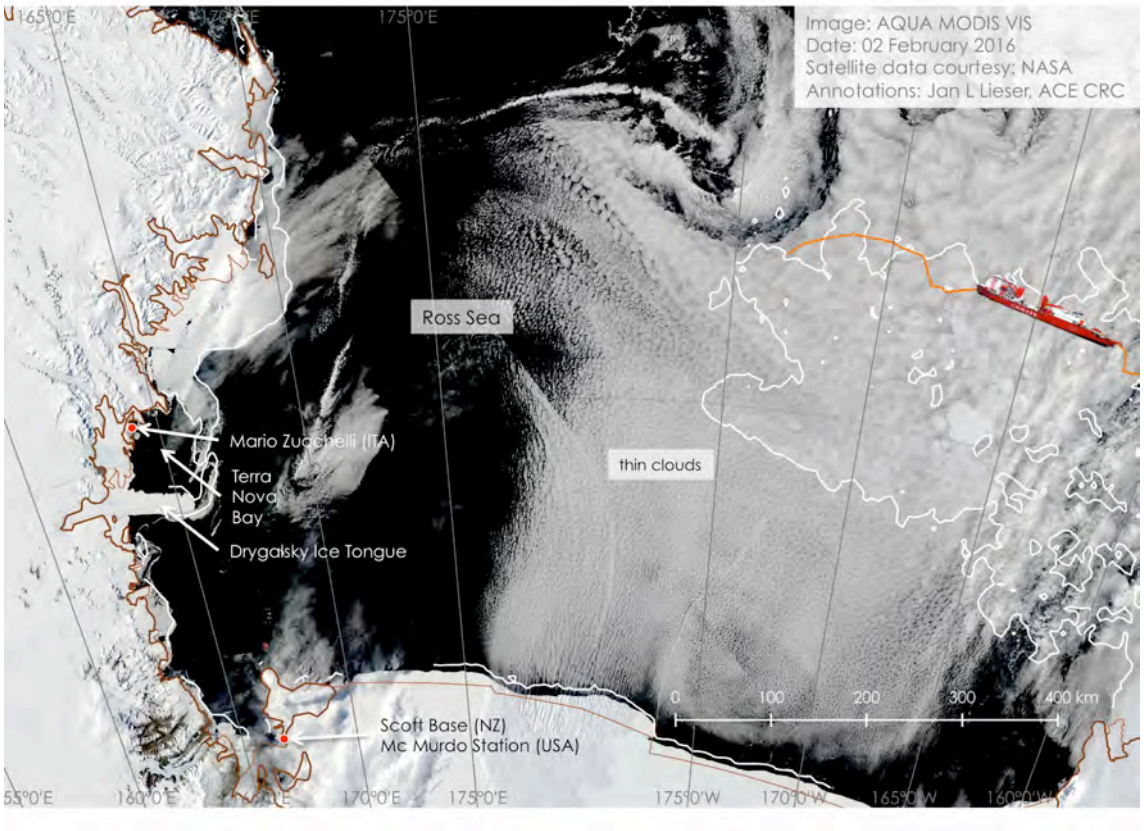

Figure 1: MODIS VIS scene, acquired 02/02/2016 and provided by NASA.

The vessel is heading west and is about to leave the sea-ice zone entering the western open ocean part of the Ross Sea. Offshore Terra Nova Bay, only very little sea ice remains, mostly as strips and patches drifting northward.

With best regards,

Jan.

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Sea Ice Report #06.3/2016

by the Antarctic Gateway Partnership Sea Ice Service*

04/02/2016

This report updates on sea-ice conditions of selected regions of the Australian Antarctic Territory.

- **K-Axis Region**
  Figure 1 shows an overview of sea-ice concentration and a high-resolution SAR scene of the region ahead of RSV *Aurora Australis*' current marine science voyage. The white dashed line denotes the proposed cruise plan, the orange line the actual track (up until 04/02/16 00:00 UT). The locations of two 'whale moorings' are marked with white dots and annotated 'R' and 'R&D'. The mooring north of Davis Station is covered by very open sea ice (roughly 30%).

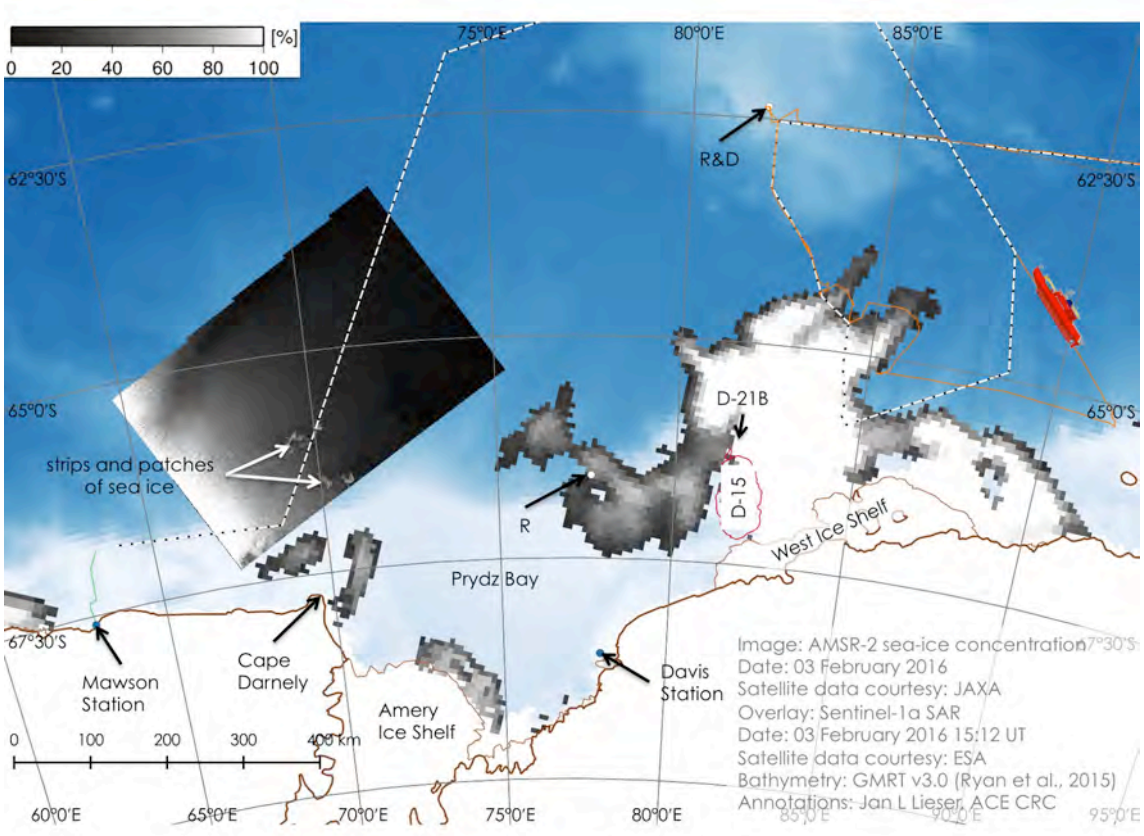

Figure 1: AMSR-2 sea-ice concentration, acquired 03/02/2016 and provided by Drift & Noise Polar Services. Sentinel-1a SAR scene, acquired 03/02/2016 and provided by PolarView.

The proposed track ahead of the vessel's current location has only minimal sea ice. North of Cape Darnley, isolated strips and patches

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of sea ice can be identified in the SAR scene, however they are below the detection limit of the AMSR-2 instrument.

East of Cape Darnley, the fast-ice tongue is breaking up and a area of melting ex-fast ice is drifting, just north of 67° 30' S, off Cape Darnley.

The typical approach into Horseshoe Harbour at Mawson Station (the green line in Figures 1 and 2) shows only very occasional ice (icebergs or old sea ice).

- **Mawson Station**
  Offshore Mawson Station, the visible MODIS image (Figure 2) shows only isolated icebergs between 'iceberg alley' and the station. East of the station, there is no fast ice attached to the shore of Lars Christensen Coast except for the remainder of fast ice east of Cape Darnley (see previous section).

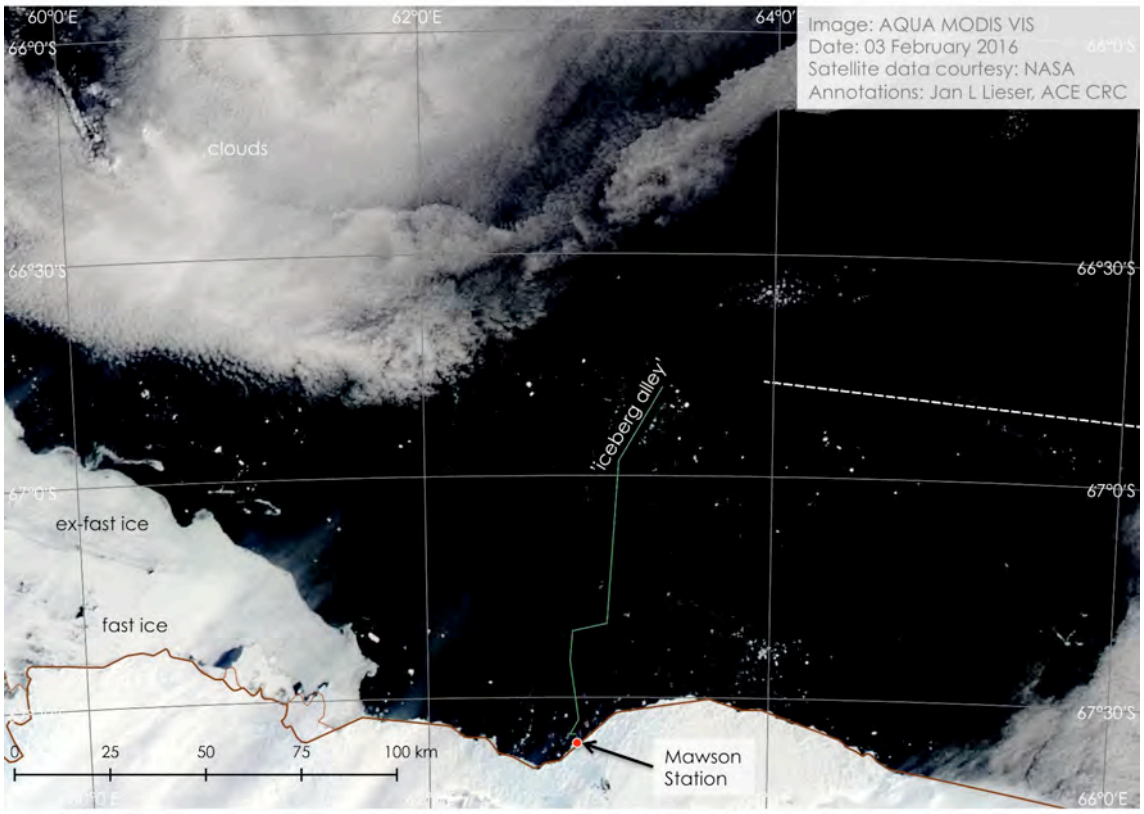

Figure 2: MODIS VIS scene, acquired 03/02/2016 and provided by NASA.

The high-resolution visible image of Figure 3 shows the islands off Mawson Station ice free. Further away from the coast, only scattered floes of old sea ice and few icebergs can be seen.

- **Sabrina Coast**
  Figure 4 shows a visible image of Law Dome and the Dalton Iceberg Tongue. Further break-up of fast ice can be detected, even though the scene is partly obscured by clouds.

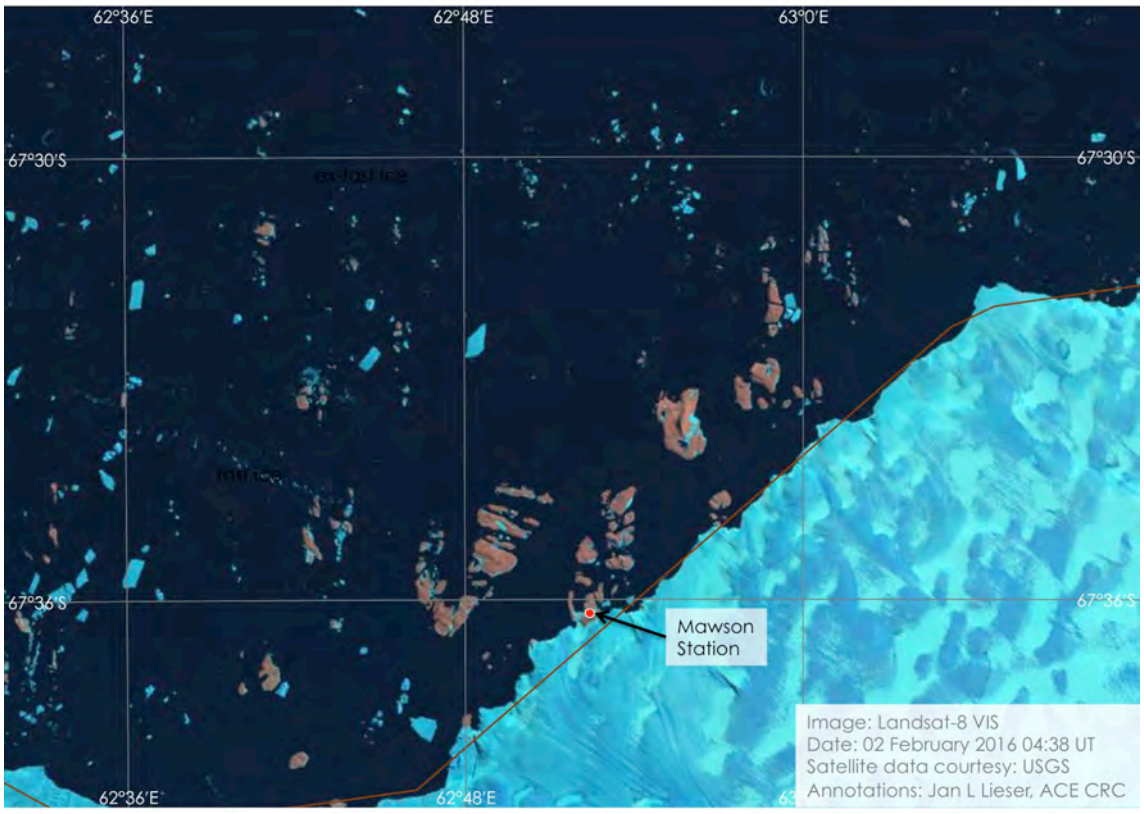

Figure 3: Landsat-8 VIS scene, acquired 02/02/2016 and provided by USGS.

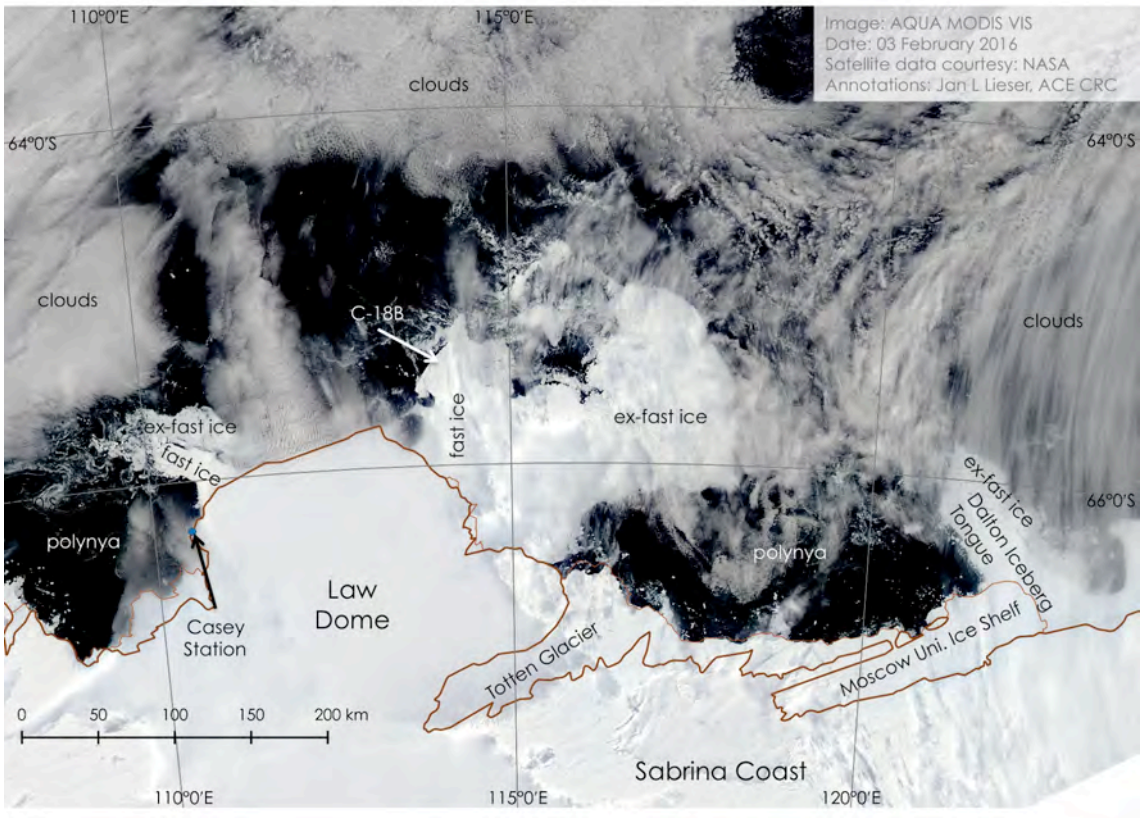

Figure 4: MODIS VIS scene, acquired 03/02/2016 and provided by NASA.

North of Casey Station, the northern half of fast ice attached to the western flank of Law Dome is breaking up and drifting westward. Also, the northern part of fast ice in between icebergs of the Dalton Iceberg Tongue is breaking up but might remain trapped between icebergs at the moment.

- **Commonwealth Bay**
  The visible image of Figure 5 shows the distribution of large icebergs and sea ice (mostly strips and patches), between Dumont D'Urville Station and Mertz Glacier. Icebergs B-9B, C-15 and C-29 remain local, but of curious note are the movements of icebergs B-39 and B-40, since their last official monitoring from 29/01/2016 (green dots). North of the oceanic shelf break, B-40 is drifting westward (roughly 13.5 nautical miles since 29/01/2016) while B-39 is still in the region of about 500 m water depth and drifting southward (almost 18 nautical miles since 29/01/2016).

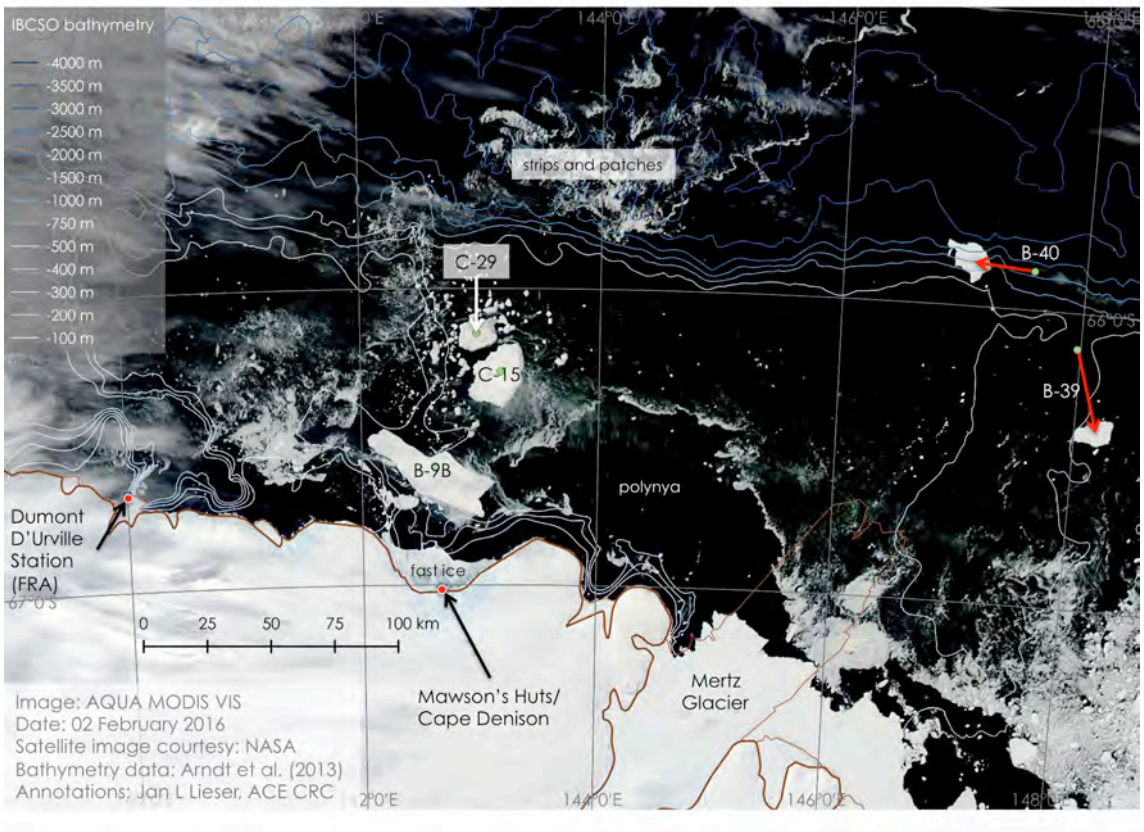

Figure 5: MODIS VIS scene, acquired 02/02/2016 and provided by NASA.

Some fast ice continues to break away from the body of fast ice inside Commonwealth Bay.

With best regards,

Jan.

Sea Ice Report #07.1/2016

by the Antarctic Gateway Partnership Sea Ice Service*

09/02/2016

- **Eastern Prydz Bay**
  A high-resolution SAR scene is shown in Figure 1. The location of a 'retrieve only whale mooring' (marked 'R') is given by a white dot.

  It is now officially recognised that iceberg D-15 has split into two parts, the larger called D-15A and the smaller part called D-15B (note: D-15B is almost the size of Flinders Island).

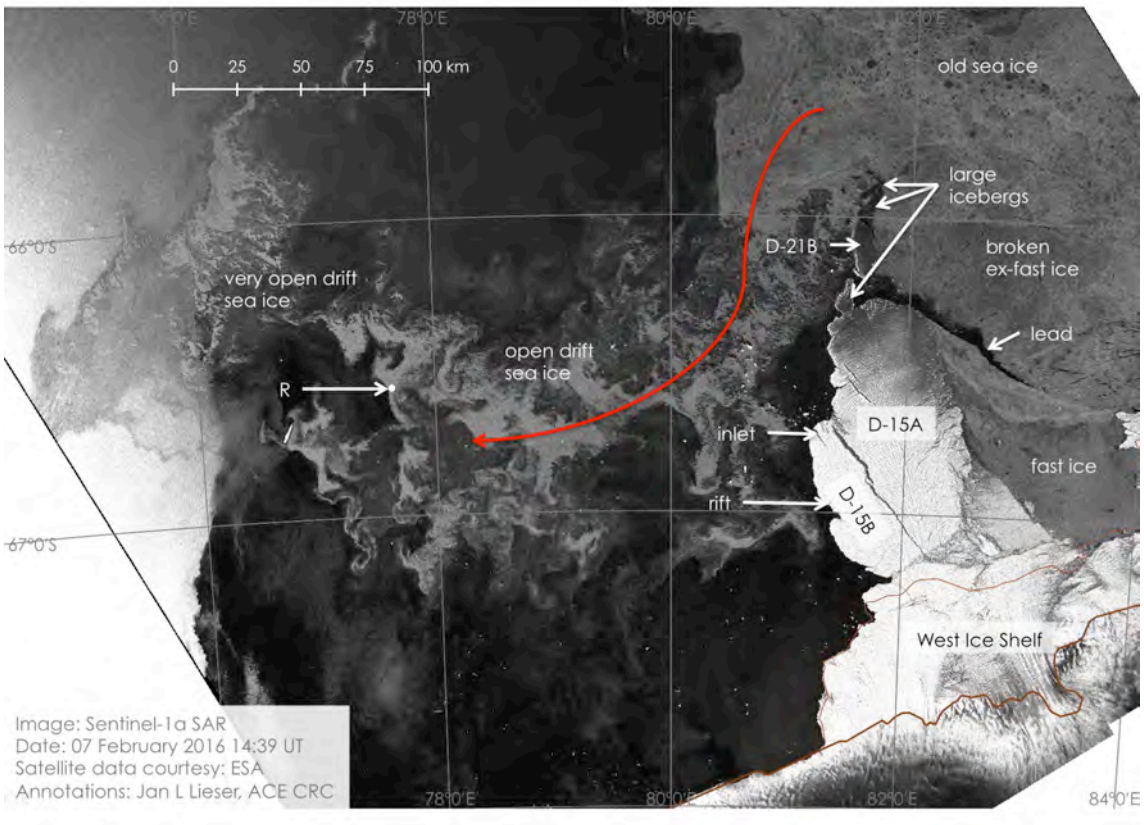

Figure 1: Sentinel-1a SAR scene, acquired 07/02/2016 and provided by PolarView.

An area of predominantly ex-fast ice and old sea ice feeds a stream of strips and patches of sea ice drifting westward into northeastern Prydz Bay (red arrow). Once the old sea ice moves around the row of icebergs along 81° 30' E, these strips and patches form open drift and very open drift sea ice areas of decaying sea ice while moving

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west. Calm conditions allow the sea ice to be moved by small scale oceanic surface eddies, as can be seen manifested in the curly structures, west of 80° 25' E and south of 66° S.

With best regards,

Jan.

Sea Ice Report #07.2/2016

by the Antarctic Gateway Partnership Sea Ice Service*

11/02/2016

- **Mawson Station**
  West of Mawson Station and east of Cape Darnley, fast ice continues to break up (Figure 1). For reference, the proposed cruise track of RSV *Aurora Australis*' current marine science voyage is given as a dashed white line and the typical approach towards Mawson Station as a green line.

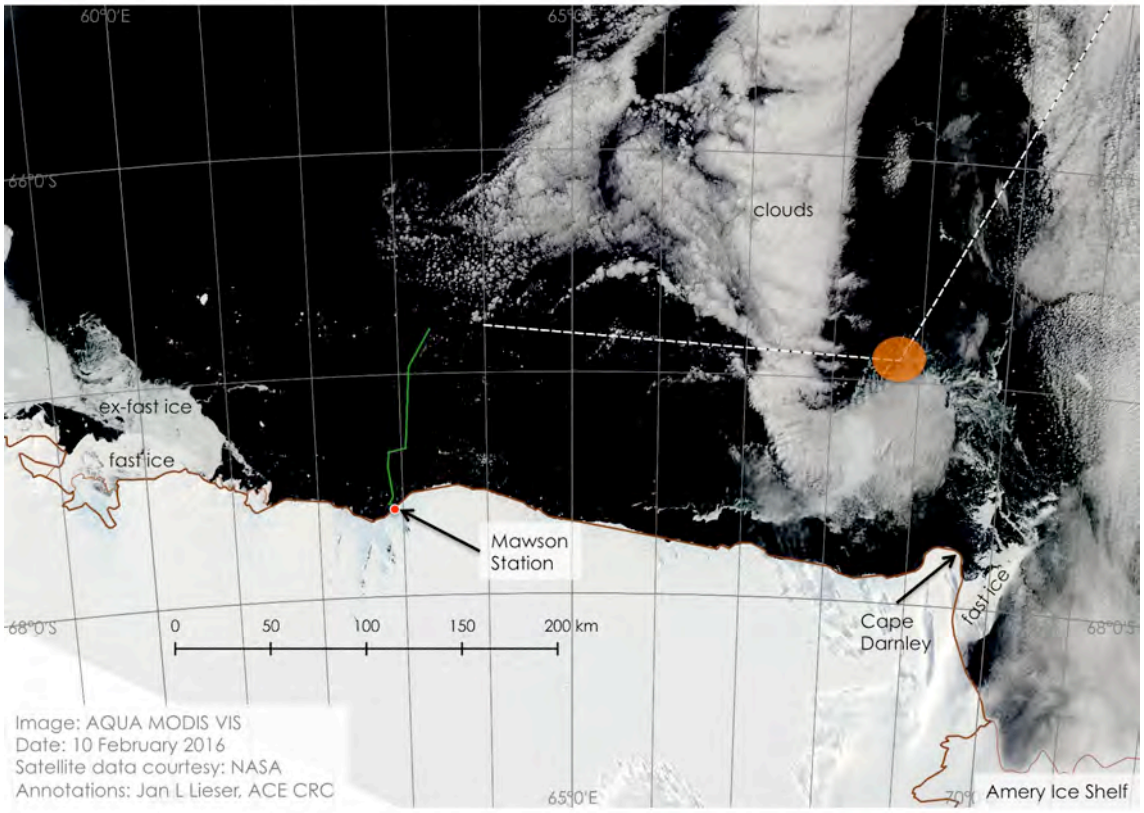

Figure 1: MODIS VIS scene, acquired 10/02/2016 and provided by NASA.

Both routes are generally ice free, except for occasional sea-ice floes (mainly in the region of the orange shape) and icebergs.

- **Davis Station**
  Further east, central Prydz Bay is also largely free of ice (Figure 2). The Vestfold Hills (home of Davis Station) and Larsemann Hills (home of three international stations) are free of fast ice. Off Davis Station, a large tabular iceberg remains local.

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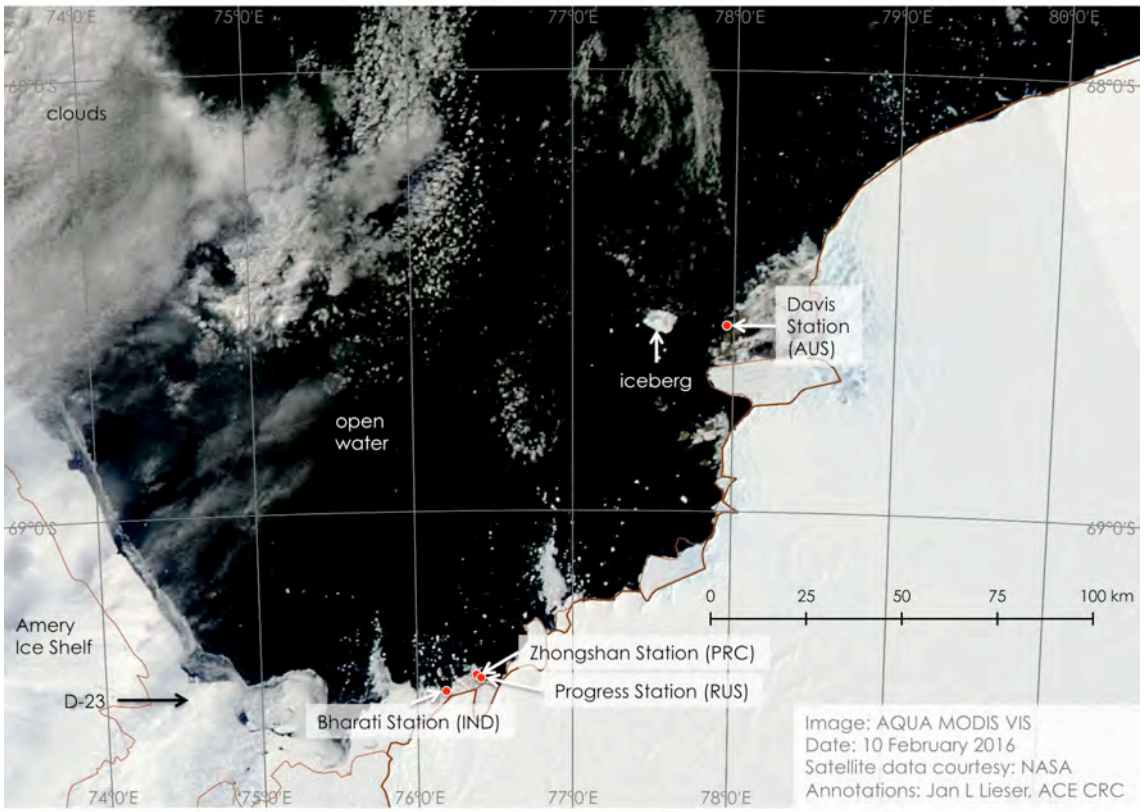

Figure 2: MODIS VIS scene, acquired 10/02/2016 and provided by NASA.

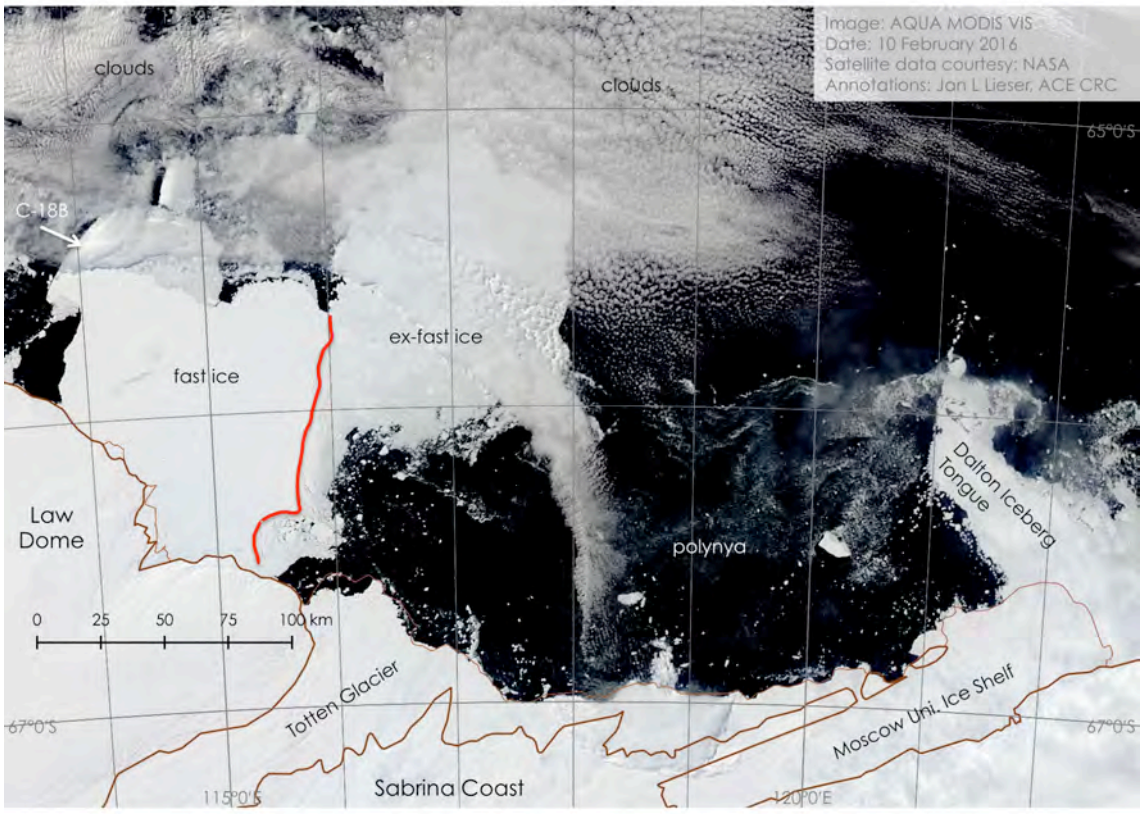

Figure 3: MODIS VIS scene, acquired 10/02/2016 and provided by NASA.

- **Sabrina Coast**
  Northeast of Law Dome, fast ice is still breaking up. The red line in Figure 3 indicates the transition between fast ice attached to the northeastern flank of Law Dome and ex-fast ice offshore. North of Totten Glacier, approximately 16 km of coast are exposed to the ocean plus additionally, roughly 7 km of broken ex-fast ice along the continental margin further along.

  Within the Dalton Iceberg Tongue, fast ice is breaking away and drifting into the polynya and northward.

- **Commonwealth Bay**
  Off Mawson's Huts/Cape Denison, fast ice is breaking off and drifting westward. Only a pyramid-shaped piece of fast ice remains inside Commonwealth Bay.

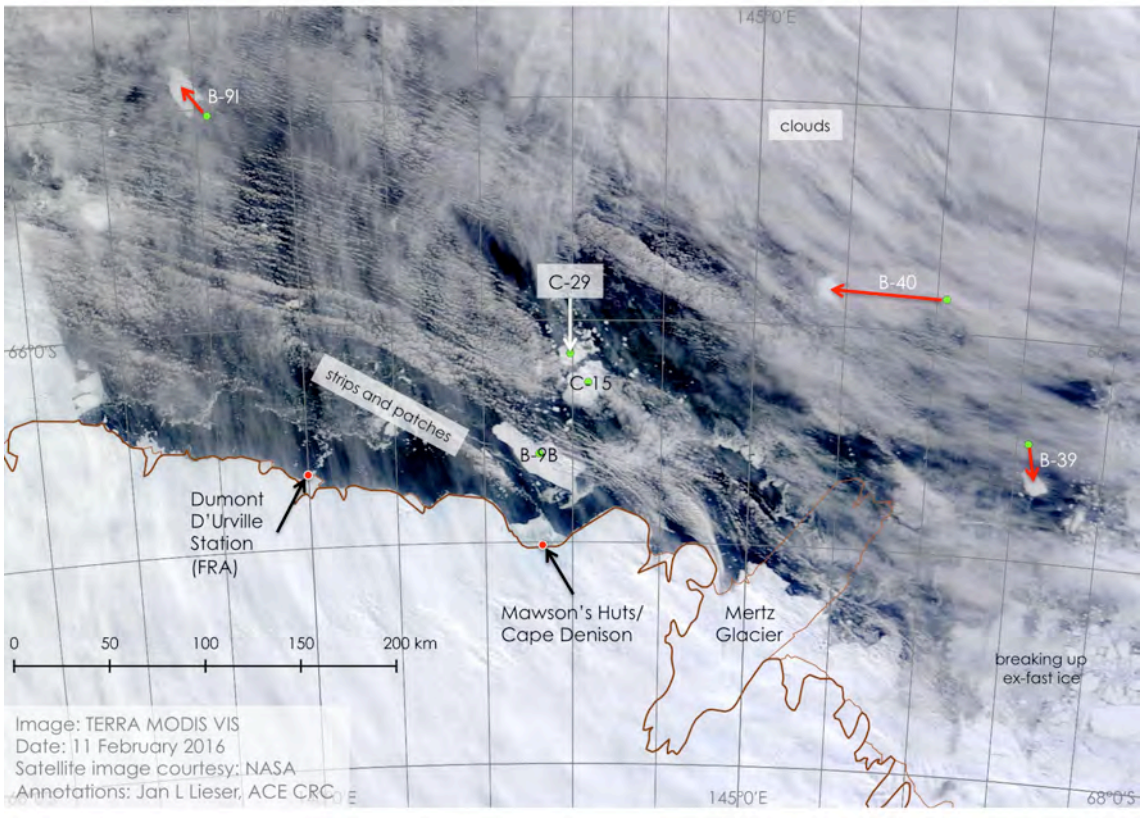

Figure 4: MODIS VIS scene, acquired 11/02/2016 and provided by NASA.

Three large icebergs north of the bay remain grounded, whereas further offshore, three other large icebergs are moving freely. Green dots denote the last observations from 05/02/2016 and red arrows show the net displacement since. B-9I has travelled roughly 18 km in northwesterly direction, B-39 circa 20 km in southerly direction and B-40 approximately 60 km westward.

With best regards,

Jan.

Sea Ice Report #07.3/2016

by the Antarctic Gateway Partnership Sea Ice Service*

12/02/2016

- **Ross Sea**
  Figure 1 shows a sea-ice concentration chart of eastern East Antarctica and the western Ross Sea. The long-term median sea-ice extent for February is indicated by the white scribble line. The cruise track of RV *XueLong*, operating in the Ross Sea, is shown by the orange line (up until 08/02/2016 02:30 UT).

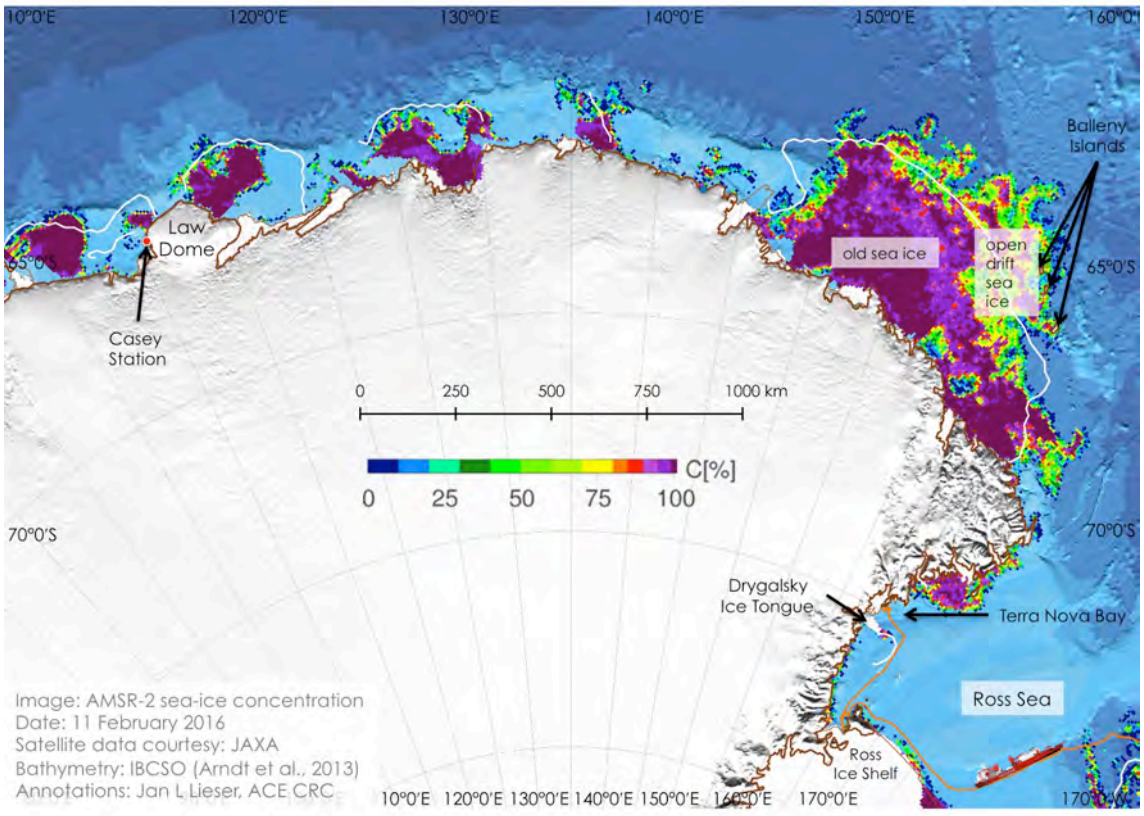

Figure 1: AMSR-2 sea-ice concentration, acquired 11/02/2016 and provided by PolarView.

There is only little sea ice left in this part of East Antarctica, as the sea-ice season comes to an end. East of the Balleny Islands, some old sea ice has survived the summer melt. Further along the coast towards the west, sea-ice extent is much below (south of) the long-term median extent.

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- **Casey Station**
  Some fast ice remains attached to the northeastern and northwestern flank of Law Dome. North of Casey Station, fast ice is still breaking up and strips and patches of old sea ice are drifting south in a little spiral, into Vincennes Bay off the station.

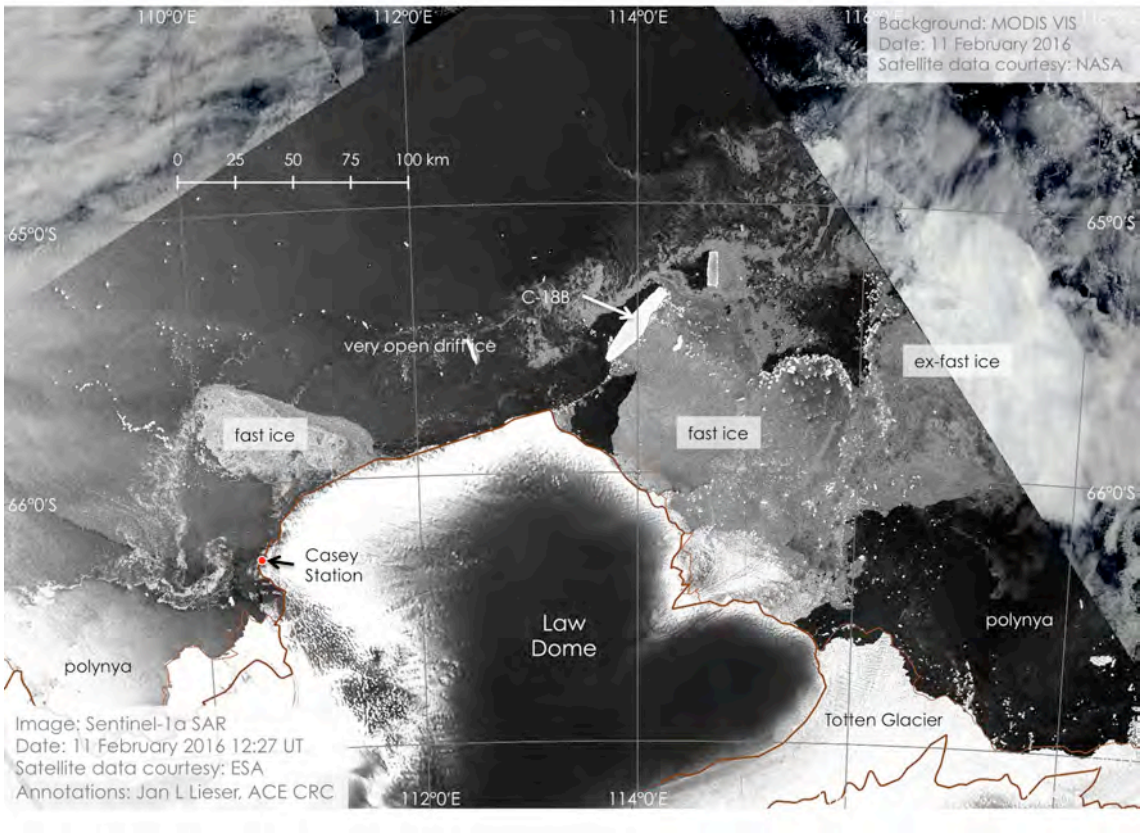

Figure 2: Sentinel-1a SAR scene, acquired 11/02/2016 and provided by ESA.

Off Totten Glacier, the huge polynya persists and some ex-fast ice is being pushed northward but remains hampered in its westward drift behind rows of icebergs that can be seen as white spots in Figure 2. Northwest of the glacier, roughly 20 km of coastline are now exposed to the ocean.

At 66° 30' S and west of 116° E, a row of new icebergs appears to be shed from the front of the glacier. This row is now located between 4 km to 5 km away for the glacier.

With best regards,

Jan.

Sea Ice Report #08.1/2016

by the Antarctic Gateway Partnership Sea Ice Service*

15/02/2016

This report updates on sea-ice conditions between 108° E and 180° E.

- **Eastern East Antarctica**
  Figure 1 shows a sea-ice concentration chart of eastern East Antarctica. The cruise track of RV *XueLong* (up until 15/02/2016 00:45 UT) leaving the Ross Sea is shown by the orange line.

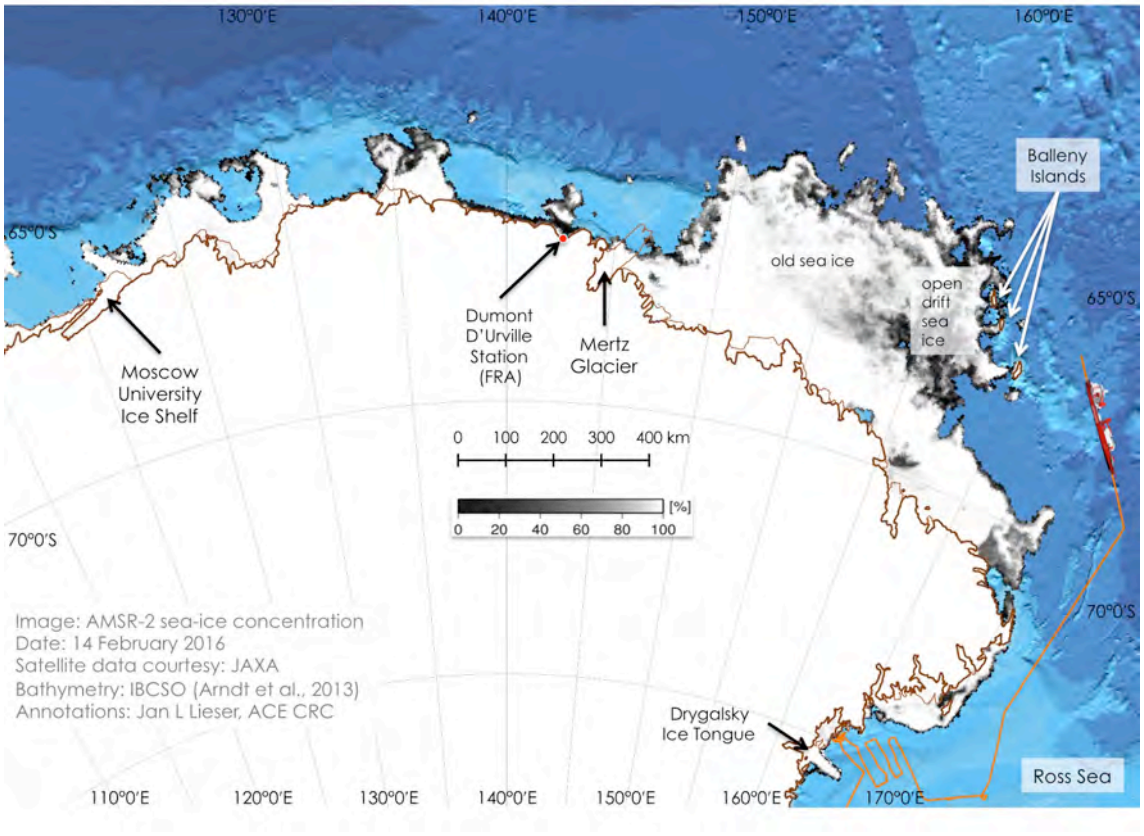

Figure 1: AMSR-2 sea-ice concentration, acquired 14/02/2016 and provided by Universiät Hamburg.

Sea ice is largely confined to south of 65° S. Only isolated patches of sea ice can be found north of this latitude.

- **Casey Station**
  Off Casey Station, breaking-up fast ice is drifting as strips and patches (very open sea ice) in northern Vincennes Bay off the station (Figure 2).

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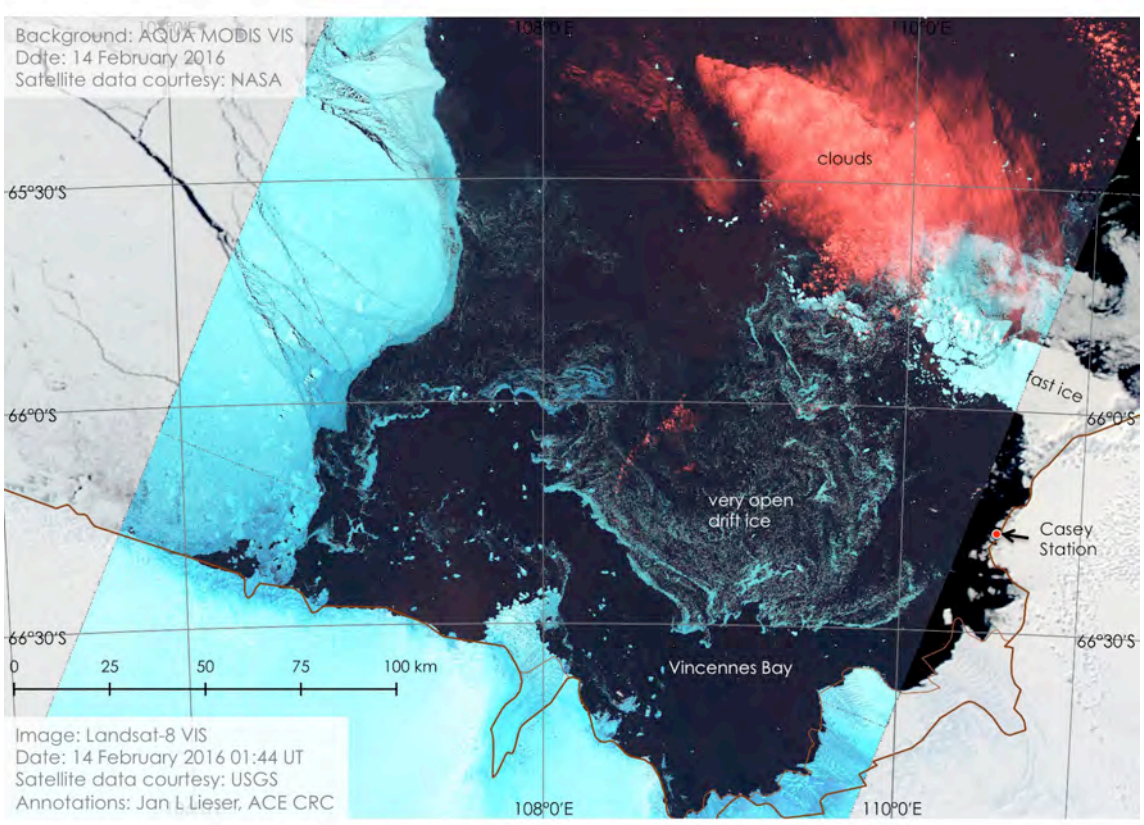

Figure 2: Landsat-8 VIS scene, acquired 14/02/2016 and provided by USGS.

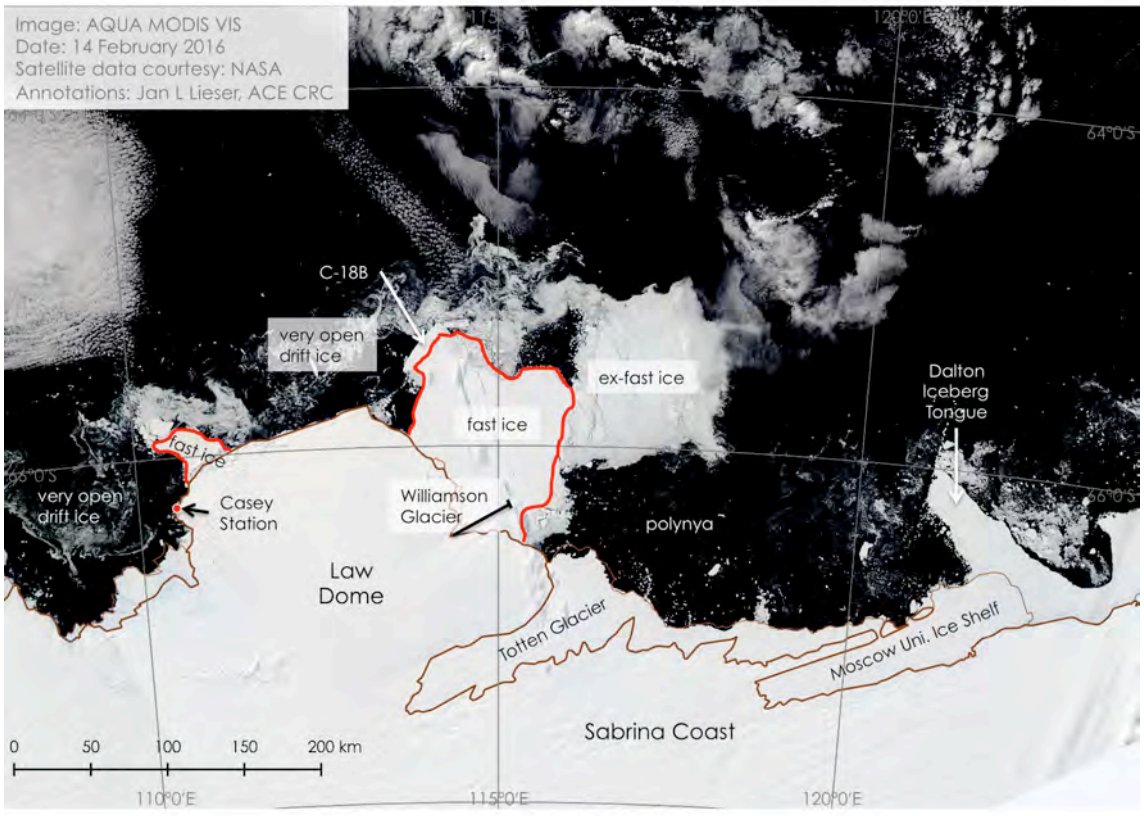

Figure 3: MODIS VIS scene, acquired 14/02/2016 and provided by NASA.

Figure 3 provides a larger context of Figure 2. The fast-ice areas northwest and northeast of Law Dome are marked with red scribble lines.

Northwest of Totten Glacier, breaking-up fast ice has now almost reached the front of Williamson Glacier (which is protruding into the fast ice and marked by the black T-line).

The southern edge of ex-fast ice being pushed away from Totten Glacier is now crossing 66° S northward.

At 66° 30' S and west of 116° E, the row of new icebergs appears to be stable in front of the glacier (see Sea Ice report #07.3/2016).

With best regards,

Jan.

Sea Ice Report #08.2/2016

by the Antarctic Gateway Partnership Sea Ice Service*

16/02/2016

- **Mawson Station**
  Figure 1 shows sea-ice conditions of northwestern Prydz Bay. For reference, the proposed cruise track of RSV *Aurora Australis*' current marine science voyage is given as a dashed white line and the typical approach towards Mawson Station as a green line. The orange line shows the vessel's actual track (up until 16/02/2016 00:00 UT), just entering the region from the north.

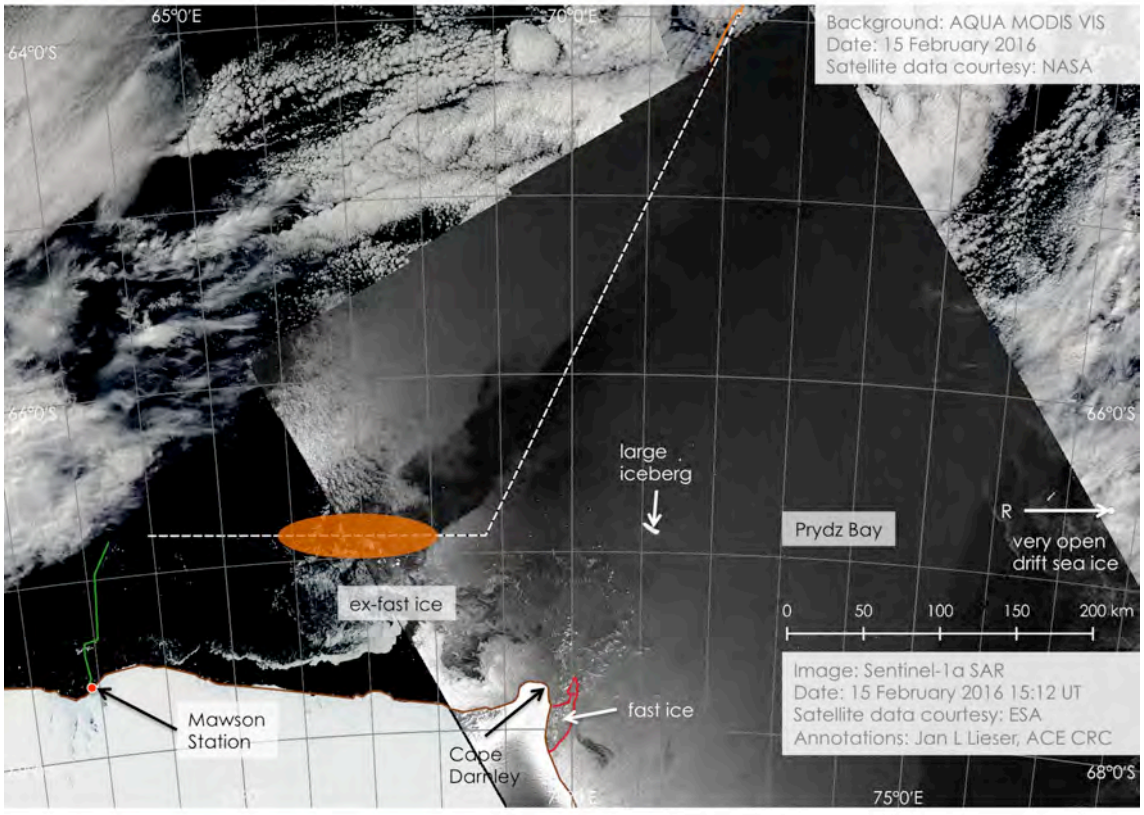

Figure 1: Sentinel-1a SAR scene, acquired 15/02/2016 and provided by PolarView. Background: MODIS-VIS scene, acquired 15/02/2016 and provided by NASA.

East of Cape Darnley, fast ice (red outline in the figure) continues to break up. Floes of disintegrating fast ice are drifting westward. The orange shape shows a region where loose patches of ex-fast ice are present in the proposed track.

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South of roughly 65° 45' S, the SAR scene also shows an increasing occurrence of smaller icebergs along the proposed track.

Further east, the location of a 'retrieve only' whale mooring (marked 'R') is just outside the SAR swath in very open drift ice. This drift ice is at the detection limit of space-borne microwave-based sea-ice concentration estimates (at and below 15%).

With best regards,

Jan.

Sea Ice Report #08.3/2016

by the Antarctic Gateway Partnership Sea Ice Service*

17/02/2016

- **Commonwealth Bay**
  Figure 1 shows sea-ice conditions off Mawson's Huts/Cape Denison, in Commonwealth Bay. The fast ice has broken out completely. Strips and patches of ex-fast ice are drifting out of the bay in northwestward direction.

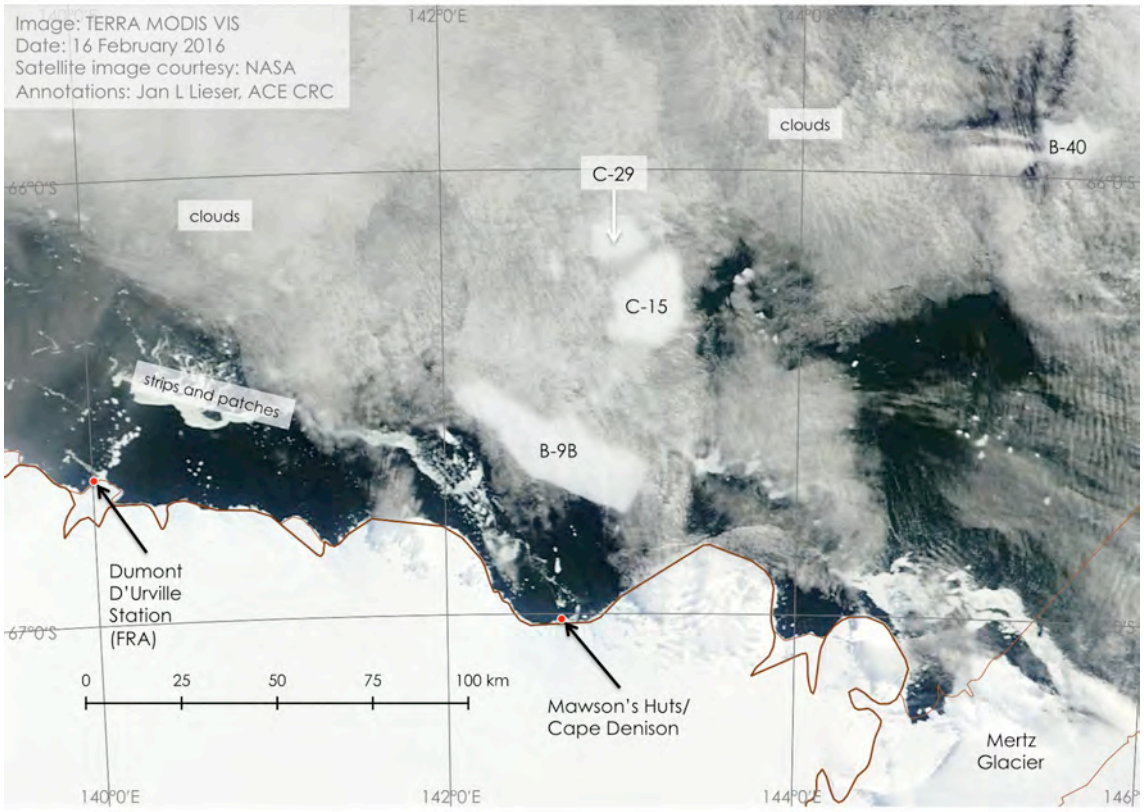

Figure 1: MODIS-VIS scene, acquired 16/02/2016 and provided by NASA.

The last time Commonwealth Bay was free of any fast ice was in early December 2010, before iceberg B-9B grounded north of the bay in March 2011, after it unhinged a major piece of the Mertz Glacier Tongue in February 2010.

With best regards,

Jan.

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Sea Ice Report #08.4/2016

by the Antarctic Gateway Partnership Sea Ice Service*

19/02/2016

This report updates on sea-ice conditions between 108° E and 125° E.

- **Casey Station**
  Figure 1 shows a visible image of East Antarctica, between Vincennes Bay and the Dalton Iceberg Tongue. The cruise track of RV *XueLong* is given by the orange line (up until 19/02/2016 01:00 UT), just entering the area from the east, roughly along 64° S. The white scribble lines denote the long-term median sea-ice extent for February.

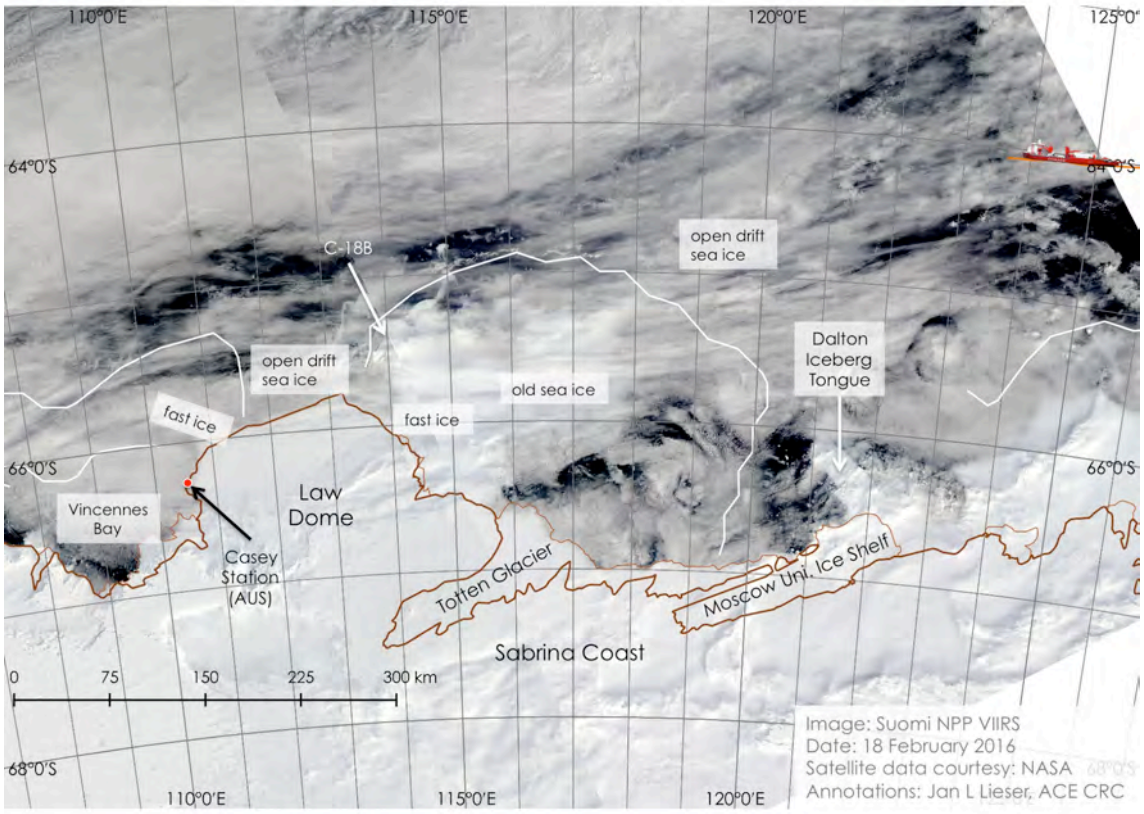

Figure 1: Suomi National Polar-orbiting Partnership (NPP) Visible Infrared Imaging Radiometer Suite (VIIRS) VIS scene, acquired 18/02/2016 and provided by NASA.

Vincennes Bay is largely free of sea ice, except for some isolated patches of ex-fast ice that has broken away for the body of fast ice attached to the northwestern flank of Law Dome.

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Overall, the sea-ice extent in the region is largely below (south of) the February median extent. North of the Totten Glacier, old sea ice and ex-fast ice is drifting northward, but largely within the boundary of the median extent. Isolated strips and patches of ice can be found northeast of this median extent, roughly between 118° E and 121° E.

With best regards,

Jan.

Sea Ice Report #09.1/2016

by the Antarctic Gateway Partnership Sea Ice Service*

22/02/2016

- **Prydz Bay**
  Figure 1 provides an overview of sea-ice conditions in the larger Prydz Bay region. The orange line denotes the recent cruise track of RSV *Aurora Australis*, currently at Mawson Station. The location of a 'retrieve only' whale mooring (marked 'R') is free of sea ice.

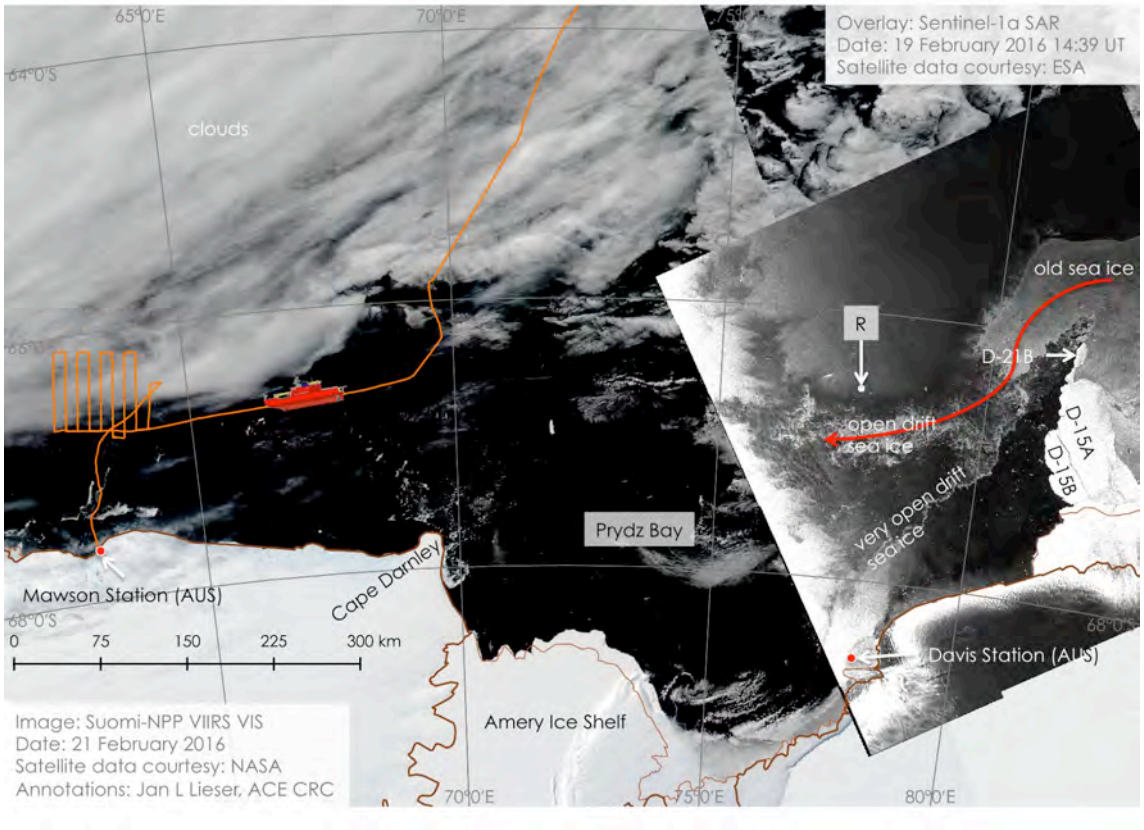

Figure 1: Suomi-NPP VIIRS VIS scene, acquired 21/02/2016 and provided by NASA; overlay: Sentinel-1a SAR scene, acquired 19/02/2016 and provided by PolarView.

East of Cape Darnley, fast ice has completely disintegrated and fragments are floating north and westward. A stream of a mixture of old sea ice and ex-fast ice continues to enter Prydz Bay from the east (red arrow). West of 80° E, this ice is dispersing into open and very open drift ice, moving south and west.

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- **Commonwealth Bay**
  Figure 2 shows sea-ice conditions west and east of the Mertz Glacier. Off Cape Denison, Commonwealth Bay is mostly free of sea ice and the locations of three large tabular icebergs (B-9B, C-15 and C-29) remain largely unchanged.

  Of curious note is a polynya north of Ninnis Glacier exposing roughly 65 km of coast to the ocean. Further to the northwest, towards Mertz Glacier, the boundary between coastal ice and breaking-up ex-fast ice is indicated by the dashed red line.

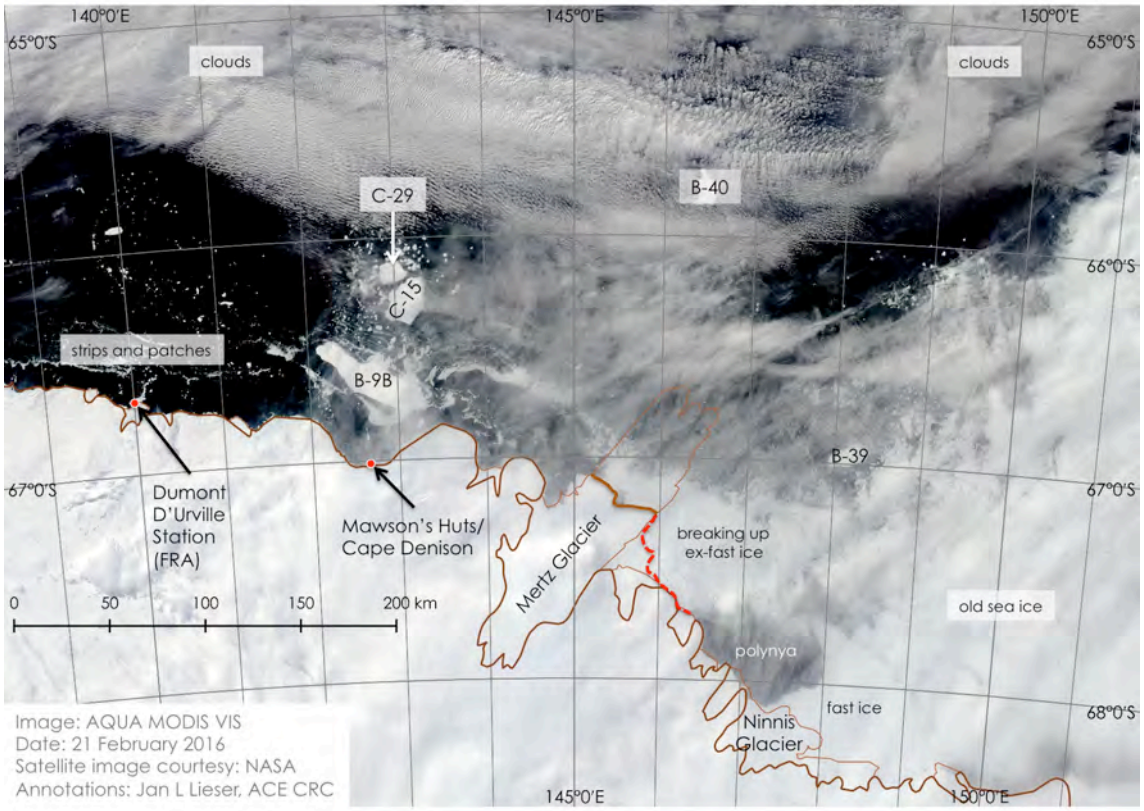

Figure 2: AQUA MODIS VIS scene, acquired 21/02/2016 and provided by NASA.

With best regards,

Jan.

Sea Ice Report #09.2/2016

by the Antarctic Gateway Partnership Sea Ice Service*

24/02/2016

- **Mawson Station**
  Figure 1 provides a high-resolution view of the ocean offshore Lars-Christensen Coast, between Mawson Station and Cape Darnley. Only minimal sea ice is present in the scene mostly as strips and patches, in the eastern part. A few tabular icebergs are also present, not only in 'iceberg alley' but also elsewhere.

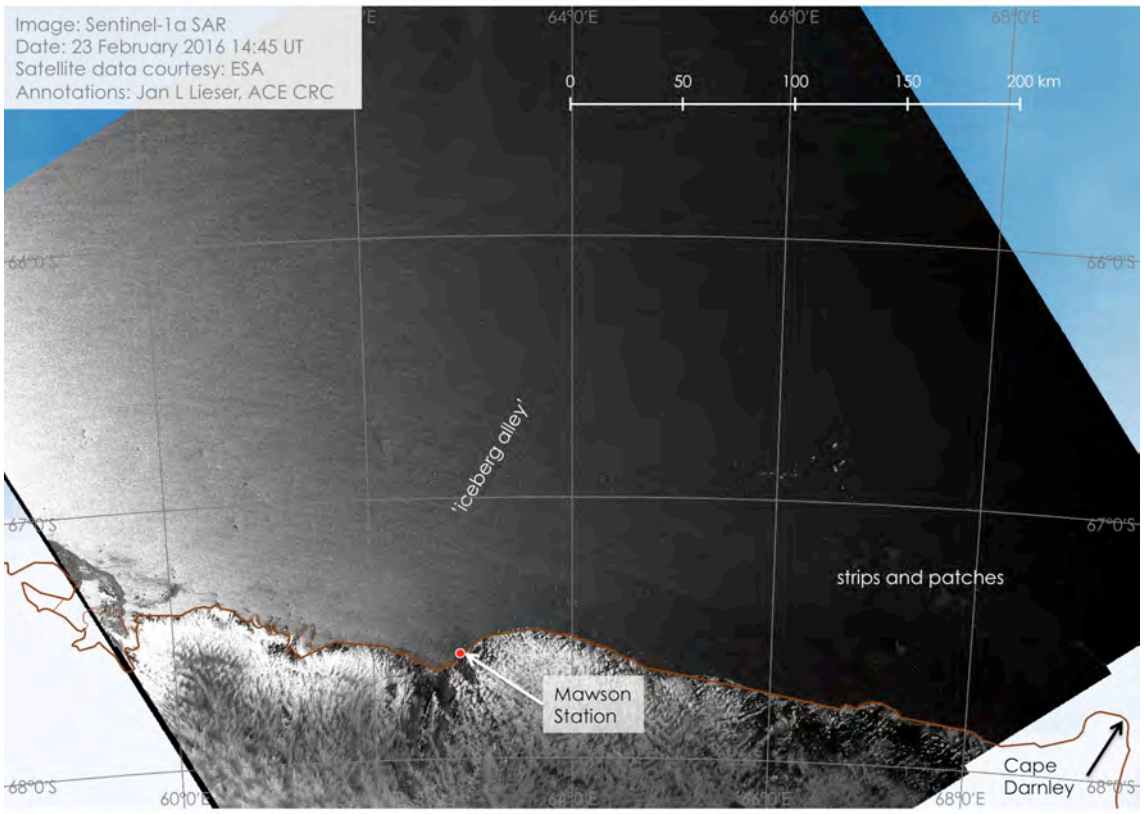

Figure 1: Sentinel-1a SAR scene, acquired 23/02/2016 and provided by PolarView.

- **East Antarctica**
  Figure 2 shows a large scale sea-ice concentration chart, off East Antarctica. The white line denotes the long-term median sea-ice extent in the region. The cruise track of RV *Xue Long* is given by the orange line (up until 24/02/2016 02:15 UT).

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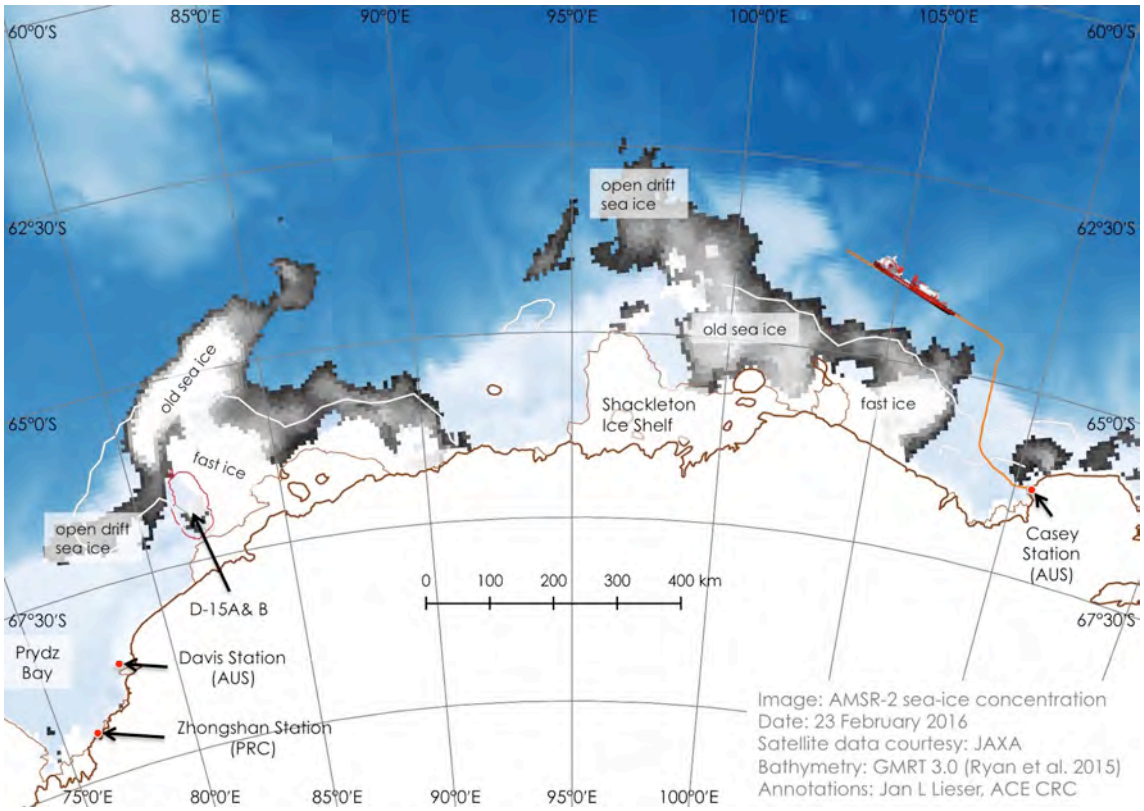

Figure 2: AMSR-2 sea-ice concentration, acquired 23/02/2016 and provided by Drift & Noise Polar Services.

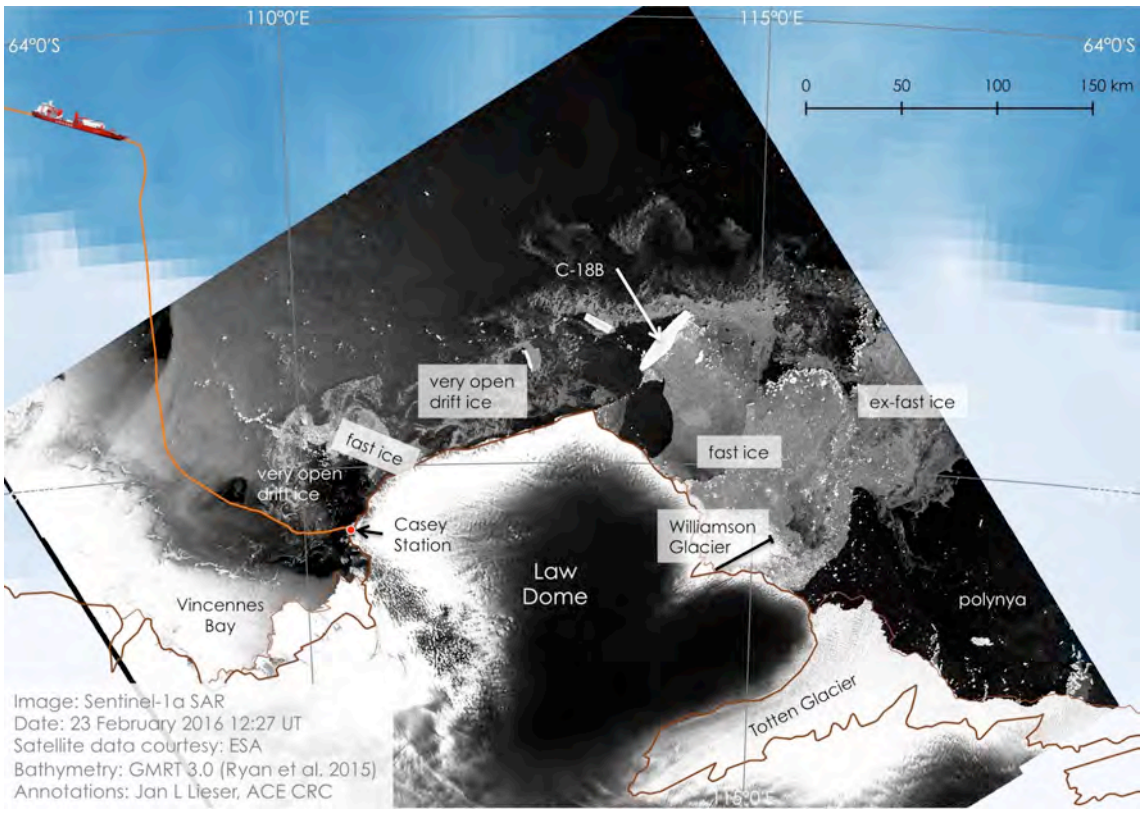

Figure 3: Sentinel-1a SAR scene, acquired 23/02/2016 and provided by PolarView.

Recently, sea-ice extent has reached its annual minimum for the 2015/16 season. Off Shackleton Ice Shelf, some open drift sea ice can be found as far north as 62° 30' S.

Prydz Bay is largely free of sea ice. Only open drift sea ice pours into the northeastern part of the bay. It consists mostly of old sea ice and ex-fast ice that has drifted around a row of large tabular icebergs north of the West Ice Shelf, including D-15A and D-15B, D-21B and at least three more large unnamed icebergs lined-up along 81° 36' E.

- **Casey Station**
  Figure 3 shows a high-resolution SAR scene of Law Dome. North of Casey Station, a patch of fast ice attached to the northwestern side of Law Dome is still breaking up and floes of ex-fast ice are drifting as very open pack into Vincennes Bay.

  Off Totten Glacier, the polynya continues to grow and roughly 17.5 km of coast are exposed to the ocean, north of the glacier.

With best regards,

Jan.

Sea Ice Report #09.3/2016

by the Antarctic Gateway Partnership Sea Ice Service*

25/02/2016

- **Davis Station**
  As mentioned in Sea Ice Report #09.2/2016, Prydz Bay is largely free of sea ice. Only open drift sea ice pours into the northeastern part of the bay (see red arrow in Figure 1). The row of large tabular icebergs north of the West Ice Shelf, including D-15A and D-15B, D-21B and at least three more large unnamed icebergs can clearly be seen in the SAR scene, all lined-up along and east of 81° 30' E.

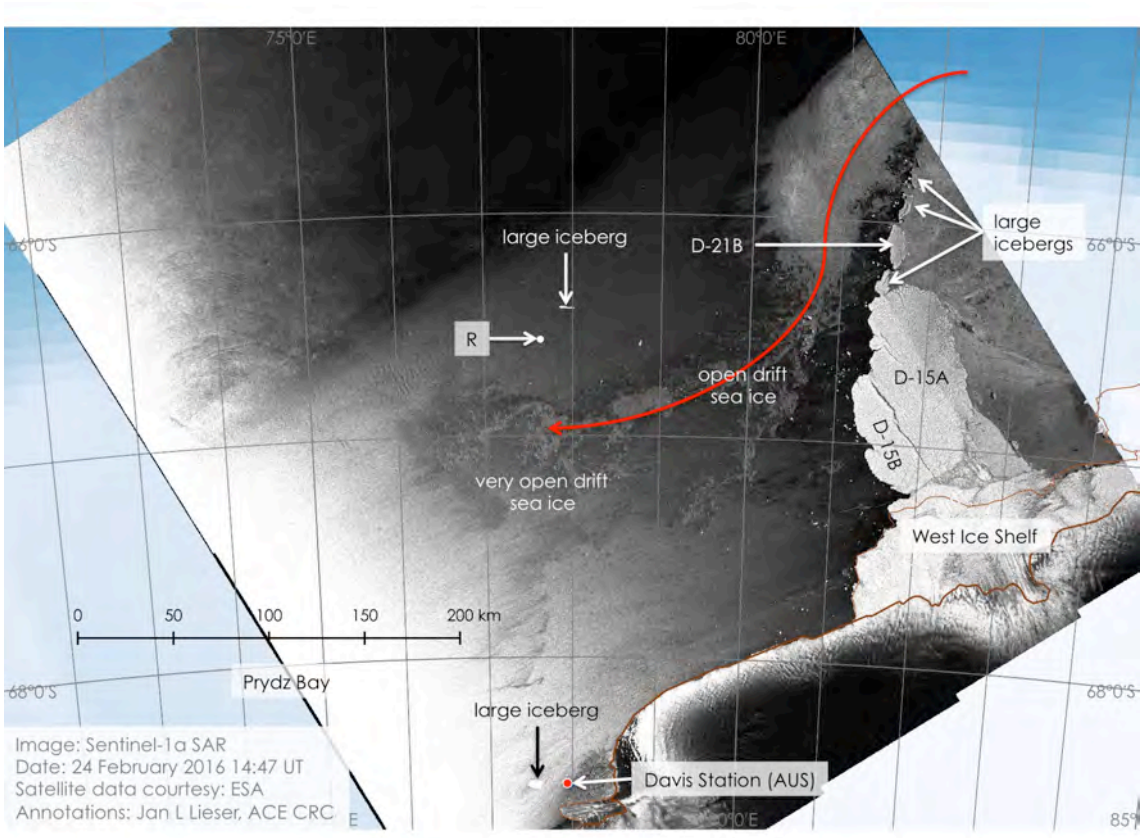

Figure 1: Sentinel-1a SAR scene, acquired 24/02/2016 and provided by PolarView.

Another large iceberg remains grounded off Davis Station.

The location of a 'retrieve only' acoustic mooring (marked 'R') is free of sea ice.

With best regards,

Jan.

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Sea Ice Report #10.1/2016

by the Antarctic Gateway Partnership Sea Ice Service*

29/02/2016

This report updates on sea-ice conditions of Prydz Bay and off Sabrina Coast.

- **Prydz Bay**
  Prydz Bay remains largely free of sea ice. Only open drift sea ice pours into the northeastern part of the bay (see Figure 2). The cruise tracks of RSV *Aurora Australis* and RV *Xue Long* (up until 29/02/2016 04:00 UT) are given by the orange and white lines, respectively. The location of a 'retrieve only' acoustic mooring (marked 'R') is free of sea ice.

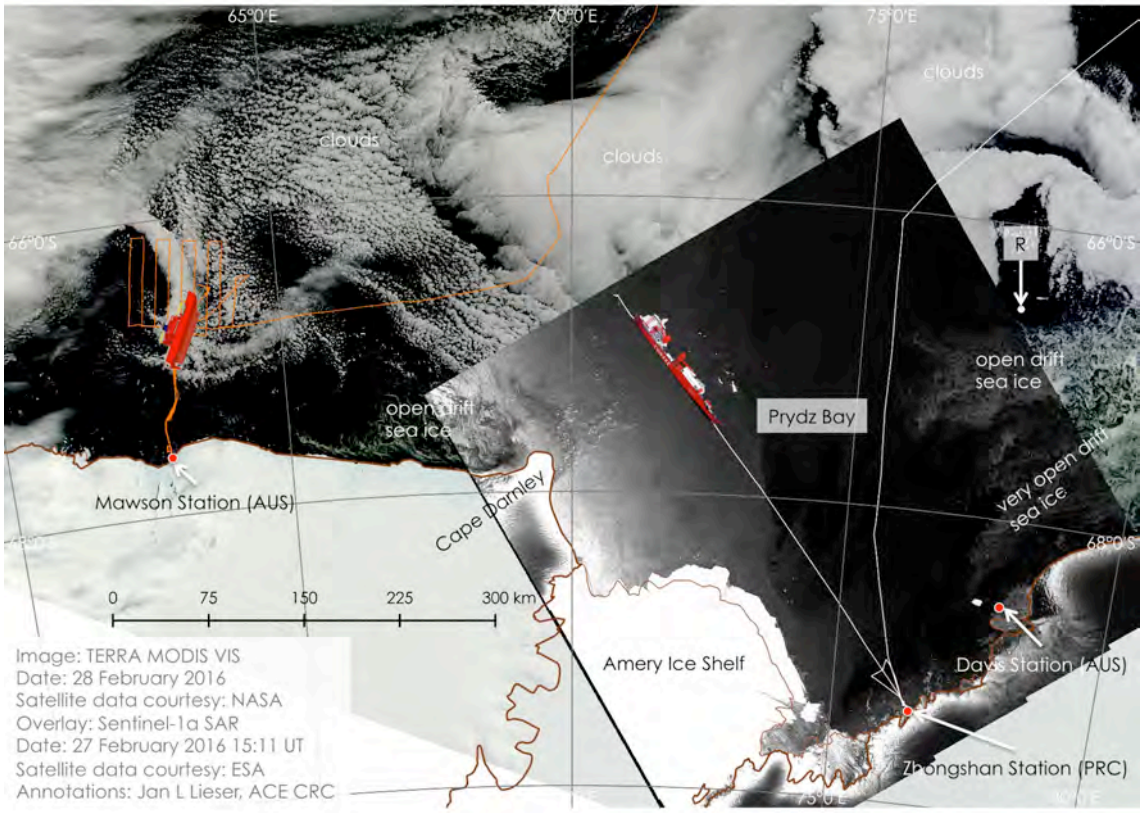

Figure 1: MODIS VIS scene, acquired 28/02/2016 and provided by NASA. Overlay: Sentinel-1a SAR scene, acquired 27/02/2016 and provided by PolarView.

North of Cape Darnley, some sea-ice formation leads to open drift ice, which exhibits a slightly greenish discolouration in the MODIS data (see Sea Ice Report #09/2012).

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- **Sabrina Coast**
  Off Totten Glacier, a large body of open water is still growing between fast ice attached to the northeastern flank of Law Dome and the Dalton Iceberg Tongue. Some icebergs can be seen close to the coast.

  Ex-fast ice is drifting northward and west once it's past a row of icebergs grounded along and east of 116° E.

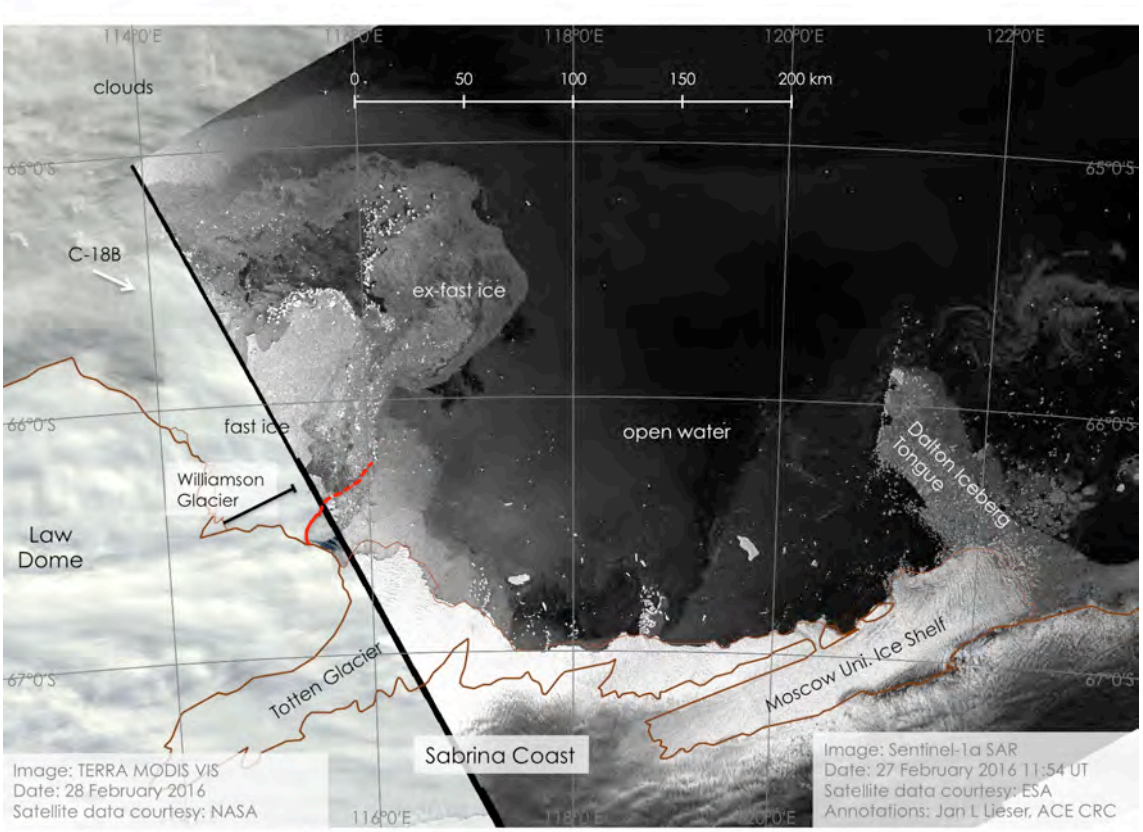

Figure 2: Sentinel-1a SAR scene, acquired 27/02/2016 and provided by PolarView. Complemented by MODIS VIS scene, acquired 28/02/2016 and provided by NASA.

North of Totten Glacier, the length of exposed coastline towards Williamson Glacier has now increased to roughly 22 km.

With best regards,

Jan.

Sea Ice Report #10.2/2016

by the Antarctic Gateway Partnership Sea Ice Service*

03/03/2016

- **Banzare Coast/Wilkes Coast**
  Figure 1 shows a high-resolution SAR scene of sea ice, off Porpoise Bay.

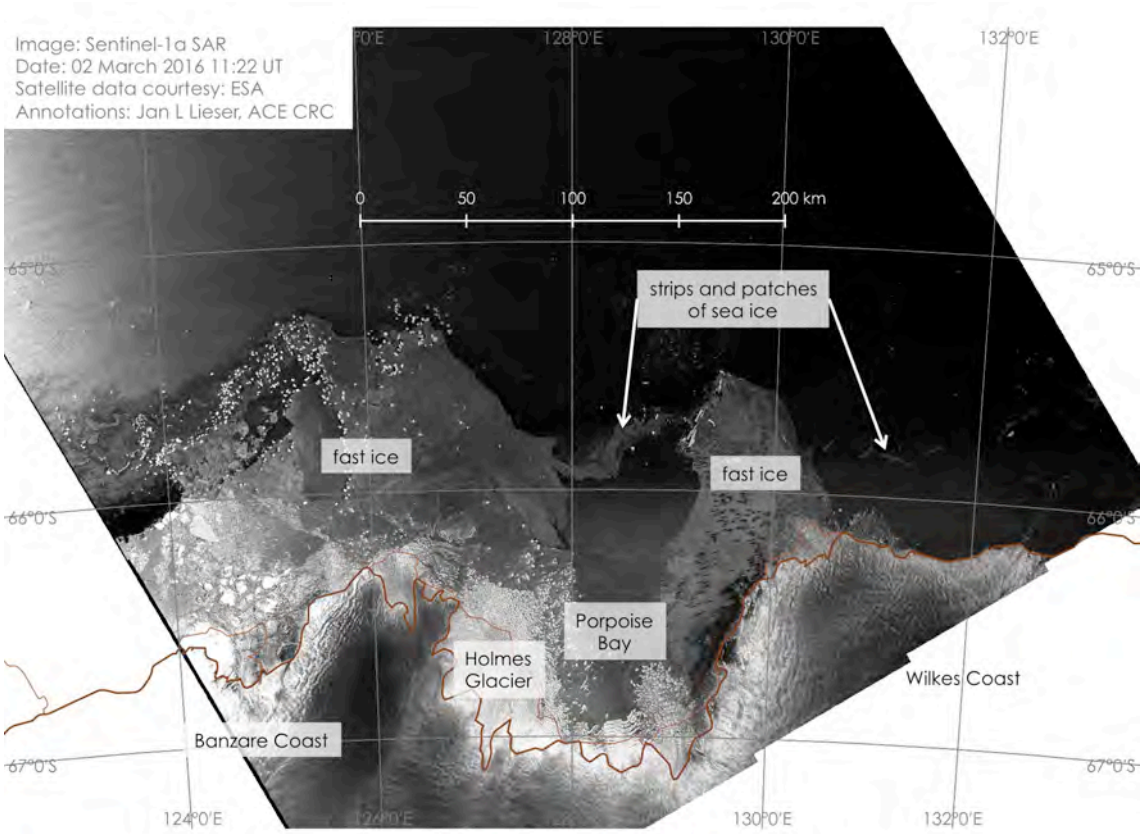

Figure 1: Sentinel-1a SAR scene, acquired 02/03/2016 and provided by PolarView.

A mixture of glacial ice and old sea ice/fast ice frames the bay. Many grounded icebergs can be seen as white dots in the image. Some freely drifting sea ice is also present in the area (strips and patches). Between 131° E and 135° E the coast is largely exposed to the ocean. There, any occurrence of sea ice is below the detection limit of the microwave-based sea-ice concentration algorithm.

With best regards,

Jan.

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Sea Ice Report #10.3/2016

by the Antarctic Gateway Partnership Sea Ice Service*

03/03/2016

In Antarctica, sea-ice growth season has started.

- **Prydz Bay**
  In Figure 1, the cruise tracks of RSV *Aurora Australis* and RV *Xue Long* (up until 03/03/2016 04:00 UT) are given by the orange and white lines, respectively. The location of a 'retrieve only' acoustic mooring (marked 'R') is now covered by open drift sea ice again.

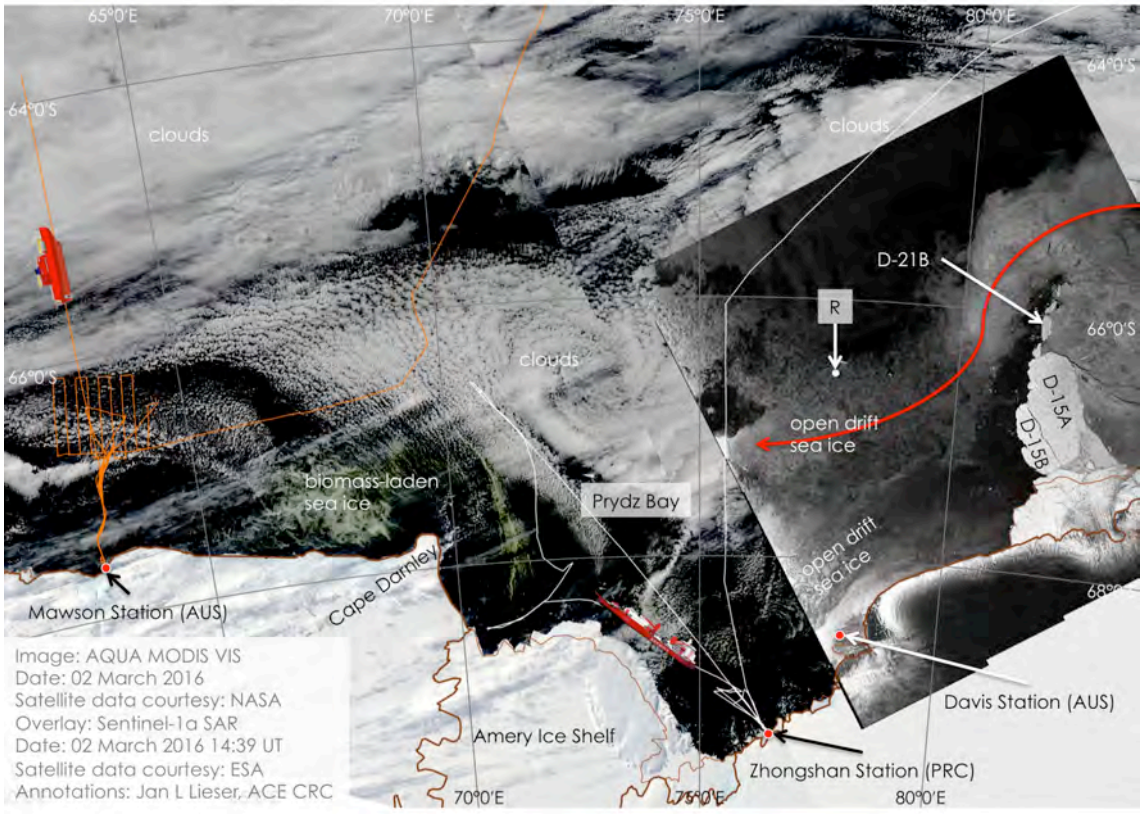

Figure 1: MODIS VIS scene, acquired 02/03/2016 and provided by NASA. Overlay: Sentinel-1a SAR scene, acquired 02/03/2016 and provided by PolarView.

Open drift sea ice pours into the northeastern part of Prydz Bay (red arrow in Figure 1). Sea-ice concentration and extent is increasing in the region as new sea ice is forming and mixing with old sea ice.

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Northwest of Cape Darnley and off the western side of the Amery Ice Shelf, sea-ice exhibits an increasing greenish discolouration in the MODIS visible data (see Sea Ice Report #10.1/2016).

With best regards,

Jan.

Sea Ice Report #11.1/2016

by the Antarctic Gateway Partnership Sea Ice Service*

07/03/2016

- **Mawson Station**
  Figure 1 shows a high-resolution SAR scene of sea ice east of Mawson Station, offshore Lars Christensen Coast. The location of icebreaker *Shirase* (JSNJ; at 06/03/2016 04:00 UT) is given by the orange dot.

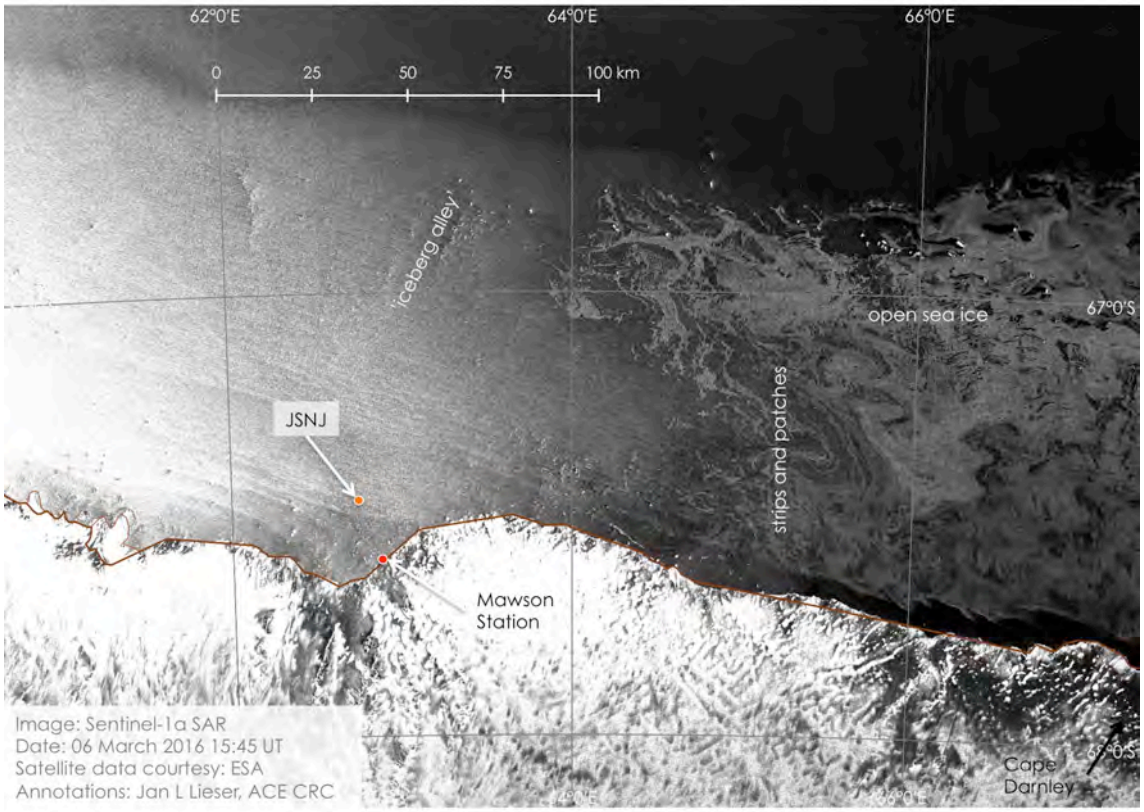

Figure 1: Sentinel-1a SAR scene, acquired 06/03/2016 and provided by PolarView.

Growing, young, sea ice is advancing from the east in strips and patches. Some drifting icebergs and large floes of old ex-fast ice are identified north of 67° S as bright white spots. 'Iceberg alley' is still free of sea ice.

- **Casey Station**
  Figure 2 shows a high-resolution SAR scene, offshore Law Dome. In Vincennes Bay, sea ice is growing and strips and patches of ex-fast

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ice are drifting in from the north. While the main body of ex-fast ice remains where is was landfast before, some open to very open sea ice is moving freely with the ocean surface currents resulting in the curly filament structures.

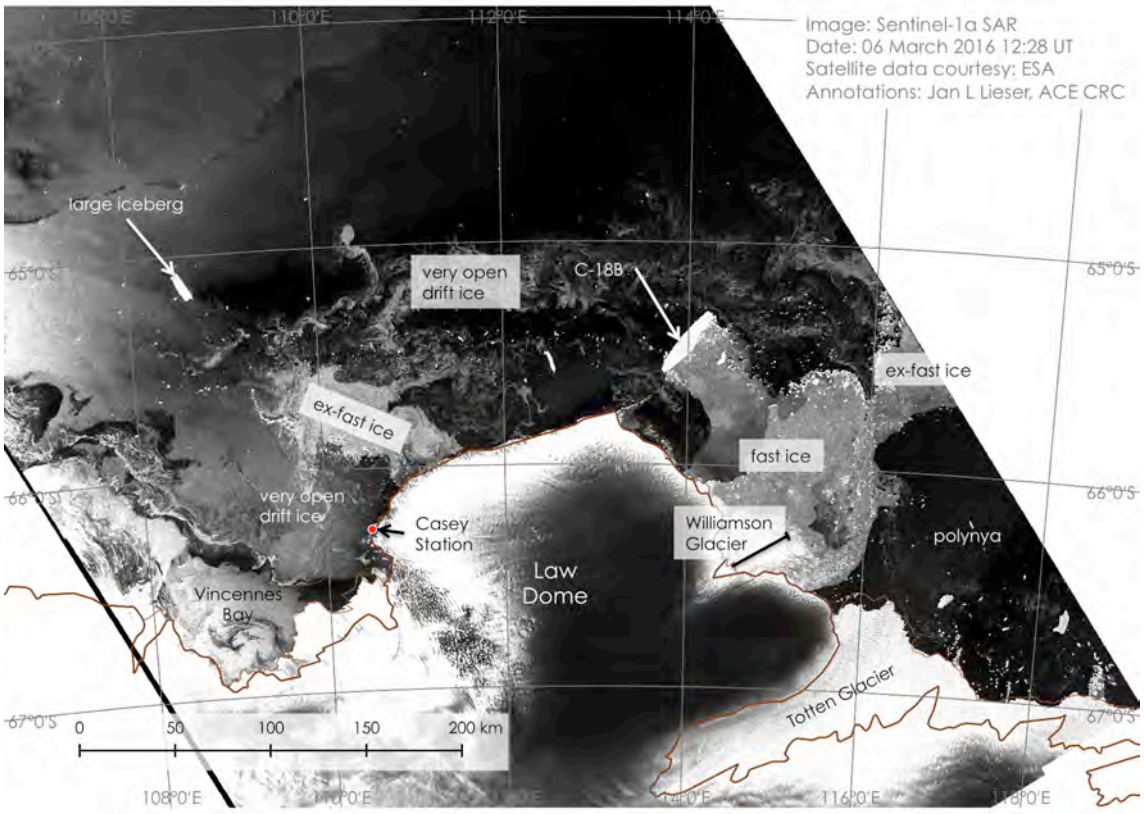

Figure 2: Sentinel-1a SAR scene, acquired 06/03/2016 and provided by PolarView.

East of Law Dome, the polynya off Totten Glacier (Sabrina Coast) is still growing. Ex-fast ice continues to be pushed northward before being transported westward with the ocean currents, once it is north of 65° 10' S.

With best regards,

Jan.

Sea Ice Report #11.2/2016

by the Antarctic Gateway Partnership Sea Ice Service*

07/03/2016

This report updated on sea-ice conditions in Prydz Bay.

- **Prydz Bay**
  Figures 1 and 2 show the same geographical frame of Prydz Bay, as seen by the AMSR-2 and MODIS instruments, respectively.

  Sea-ice concentration is increasing in eastern and western Prydz Bay, while the central part of the bay remains largely ice free. A mixture of old sea ice entering Prydz Bay from the northeast (behind a row of icebergs including D-21B, D-15A and B) and newly forming sea ice is moving south, along the eastern coast of the bay. This tongue of sea ice is now passing Davis Station. At this stage, it is open drift sea ice at medium to low concentration.

  A large (unnamed) iceberg remains grounded, offshore Davis Station.

With best regards,

Jan.

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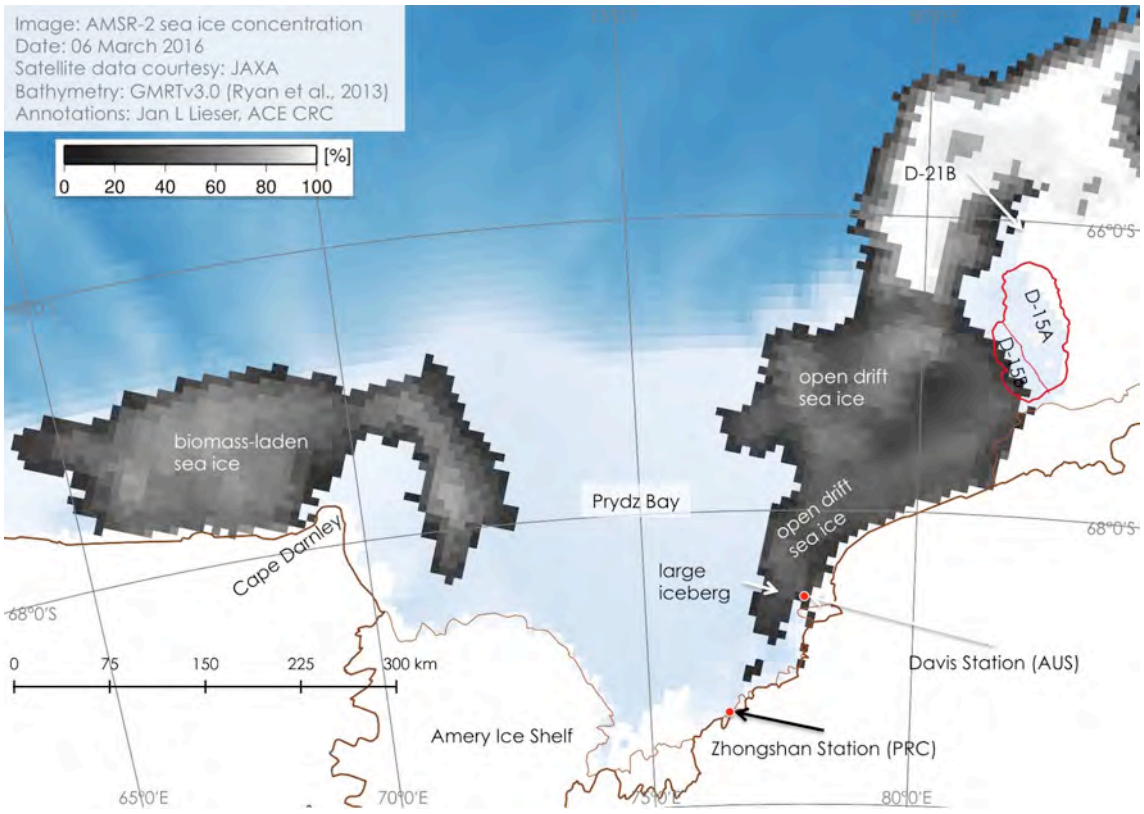

Figure 1: AMSR-2 sea-ice concentration, acquired 06/03/2016 and provided by Drift & Noise Polar Services.

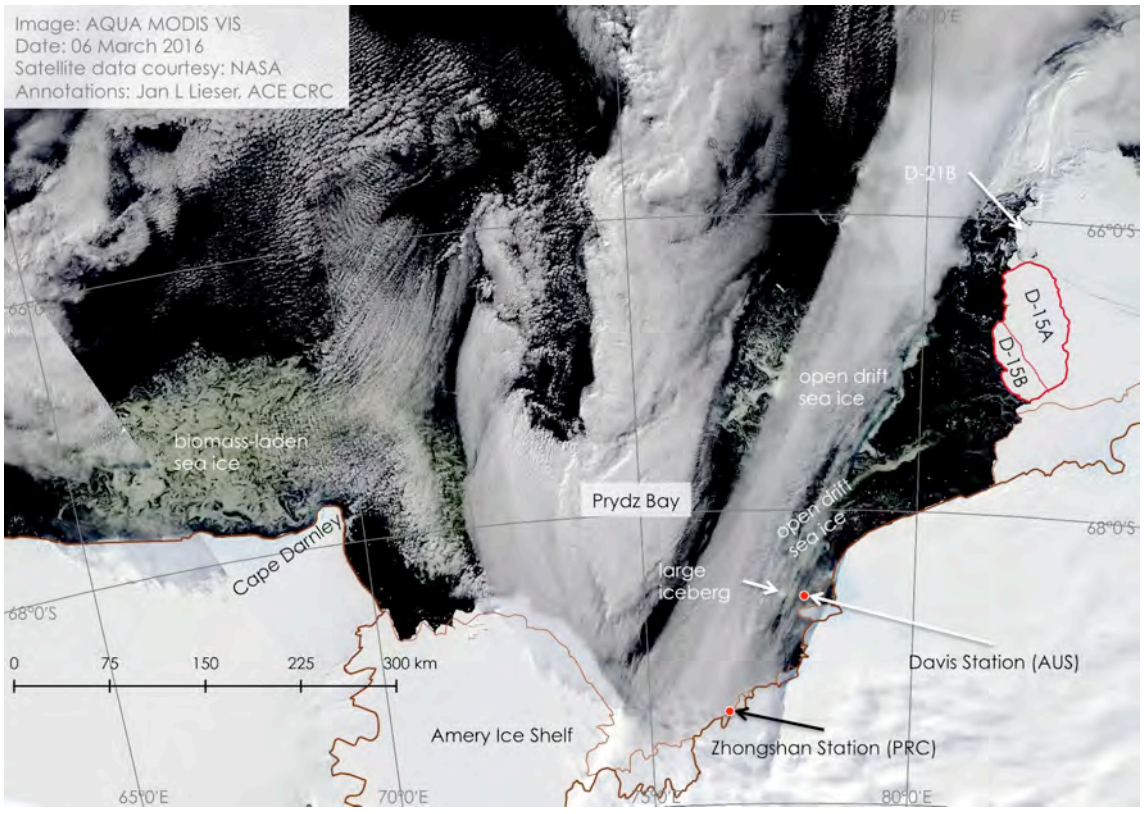

Figure 2: MODIS VIS scene, acquired 06/03/2016 and provided by NASA.

Sea Ice Report #11.3/2016

by the Antarctic Gateway Partnership Sea Ice Service*

09/03/2016

This report updates on sea-ice conditions off Totten and Mertz glaciers.

- **Sabrina Coast**
  Figure 1 provides a largely cloud-free view of the polynya offshore Sabrina Coast at very high resolution (30 m).

  A large body of fast ice remains attached to the northeastern side of Law Dome. Northeast of that, ex-fast ice is identified (slightly obscured by clouds) drifting further north. The dashed red line indicates a current fault line in the fast ice. To the southeast of this line is broken ex-fast ice.

  The length of exposed coast west of the Totten Glacier is now roughly 22.5 km.

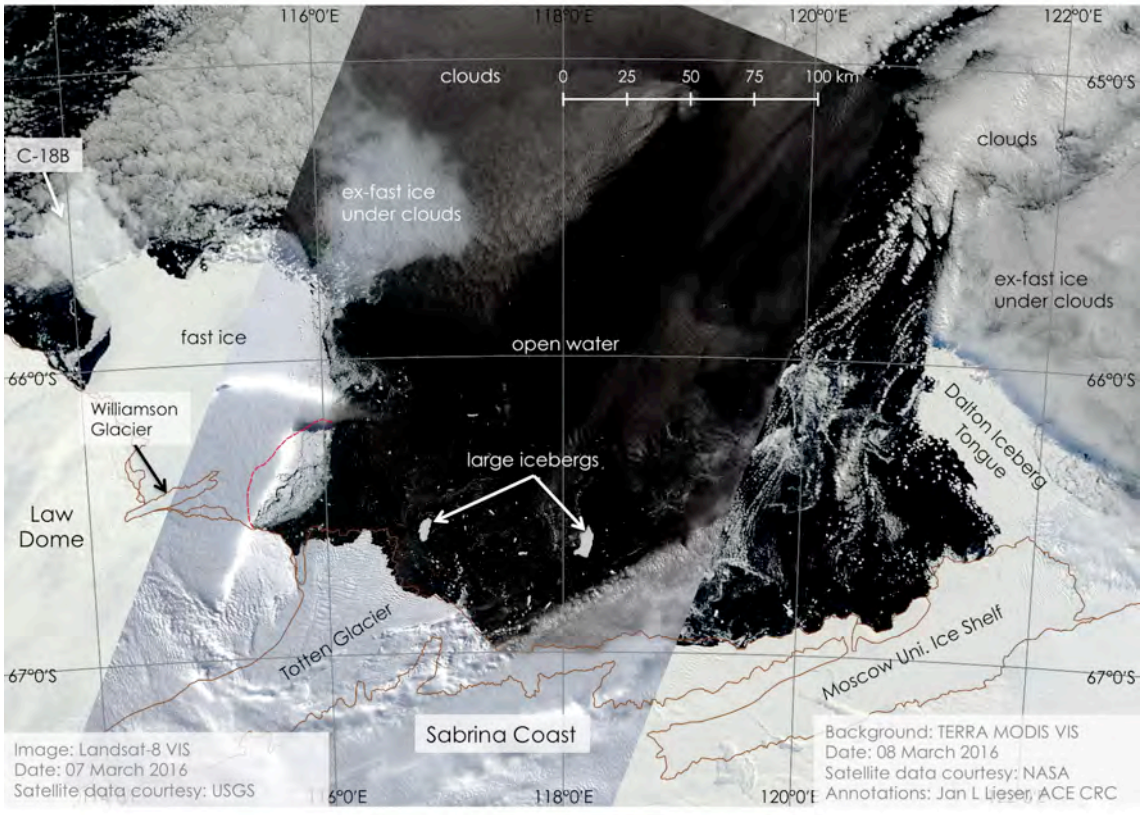

Figure 1: Landsat-8 VIS scene, acquired 07/03/2016 and provided by USGS. Background: MODIS VIS scene, acquired 08/03/2016 and provided by NASA.

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Two large pieces of glacial ice can be seen drifting in the southern part of the polynya.

- **Mertz Glacier**
  In the Mertz Glacier region, newly forming sea ice can be seen in Figure 2. Strong offshore winds create a fan-like structure of sea ice, off the Mertz Glacier and north of Ninnis Glacier.

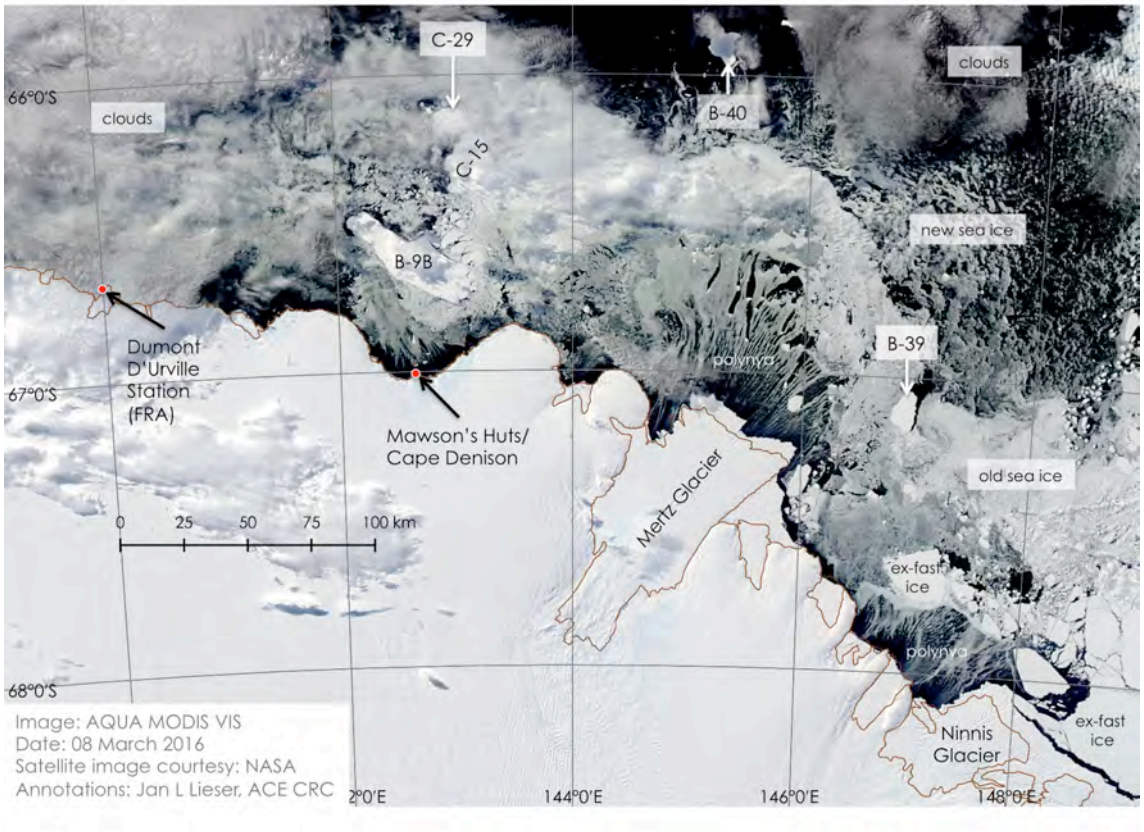

Figure 2: MODIS VIS scene, acquired 08/03/2016 and provided by NASA.

Five large tabular icebergs are identified in the scene and some vast floes of ex-fast ice can also be seen, offshore Ninnis Glacier.

With best regards,

Jan.

Sea Ice Report #11.4/2016

by the Antarctic Gateway Partnership Sea Ice Service*

10/03/2016

This report provides an update on sea-ice conditions between the Shackleton Ice Shelf and Law Dome.

- **Casey Station**
  Yesterday's sea-ice concentration chart is shown in Figure 1 together with the long-term median sea-ice extent for March as a white line. The voyage track of icebreaker *Shirase* (up until 10/03/2016 00:00 UT) is given by the red line, just entering the scene from the west.

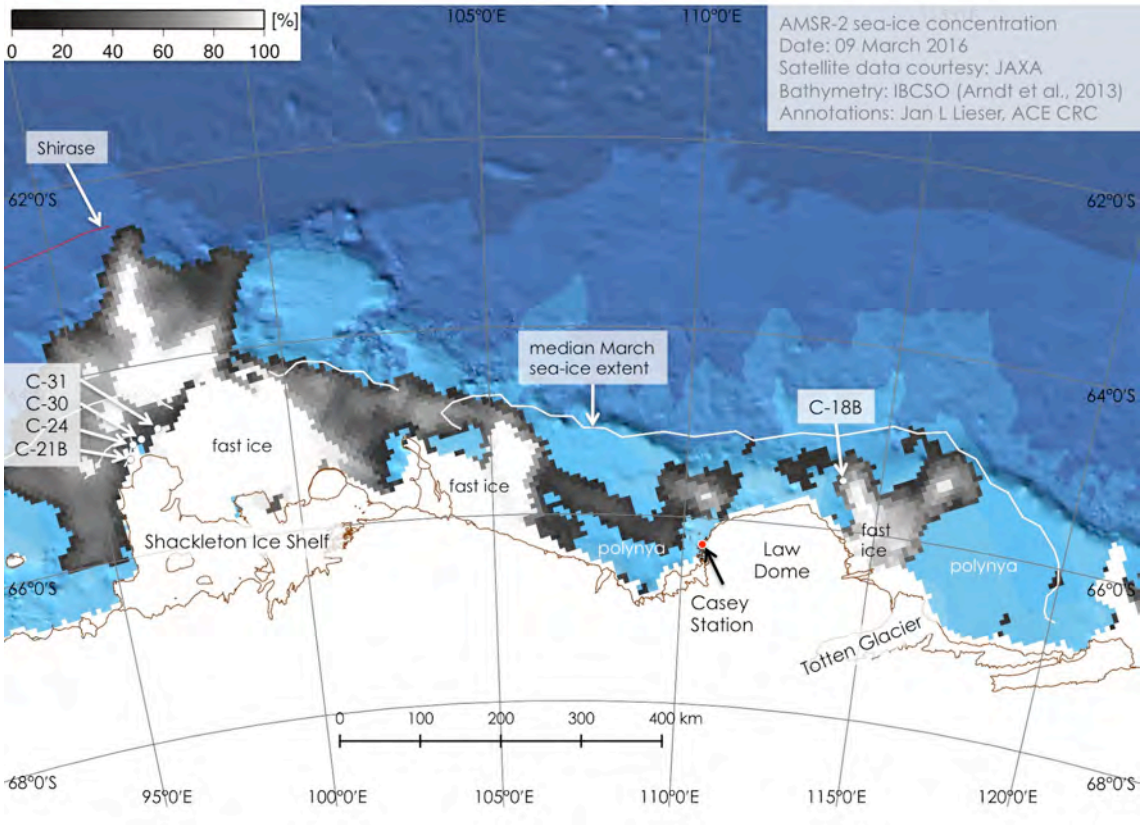

Figure 1: AMSR-2 sea-ice concentration, acquired 09/03/2016 and provided by Drift & Noise Polar Services.

While sea-ice extent northwest of the Shackleton Ice Shelf is about 110 nautical miles north of the median for March, it is on the median roughly between 100° E and 105° E and much below (south of) the median, east of 105° E. This highlights the inter-annual variability of sea-ice advance in the region.

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In Vincennes Bay, off Casey Station, a polynya exists that is separated from the ocean only by low to medium high sea-ice concentration. North of the station, some old, broken ex-fast ice remains, which can reach up to 100% sea-ice concentration, in isolated patches.

With best regards,

Jan.

Sea Ice Report #11.5/2016

by the Antarctic Gateway Partnership Sea Ice Service*

11/03/2016

- **Casey Station**
  A higher-resolution sea-ice concentration chart is shown in Figure 1, for yesterday. The long-term median sea-ice extent for March is indicated by a white line. The voyage track of icebreaker *Shirase* (up until 11/03/2016 00:00 UT) is given by the orange line.

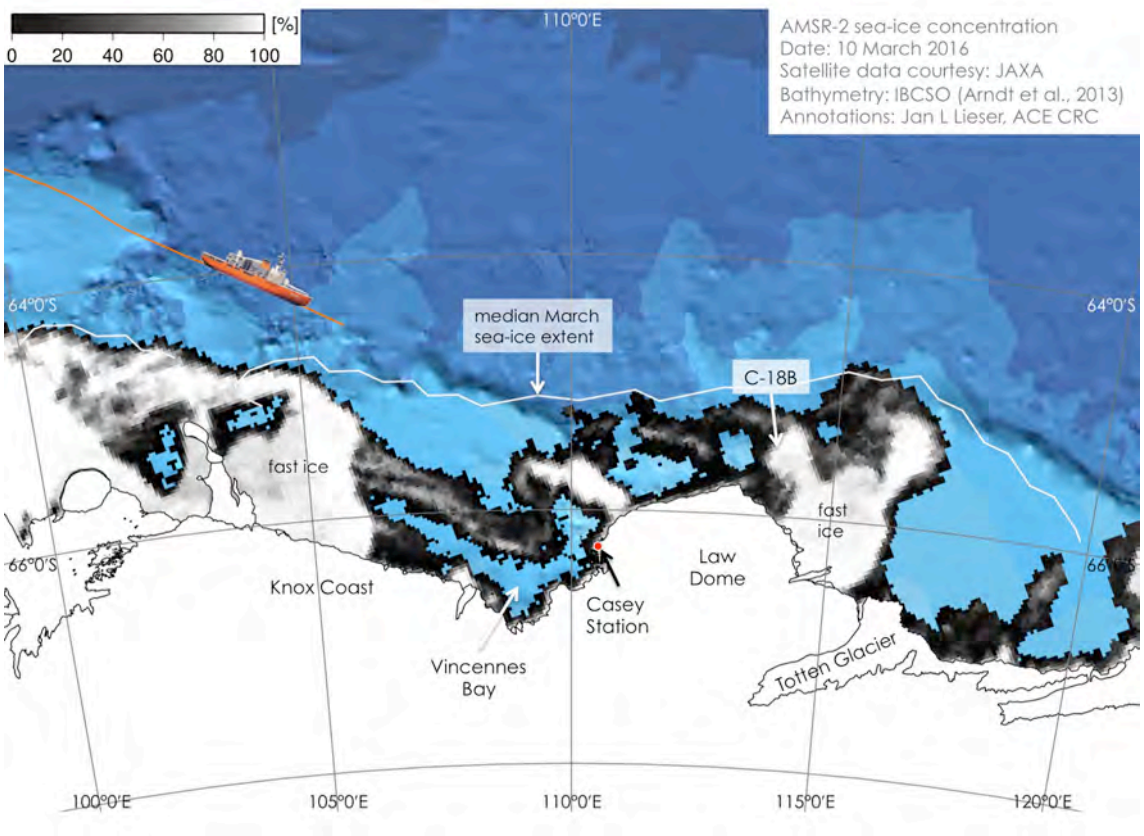

Figure 1: AMSR-2 sea-ice concentration, acquired 10/03/2016 and provided by Universität Hamburg.

In Vincennes Bay, low to medium-high sea-ice concentration can be seen. North of Casey Station, some old, broken ex-fast ice remains, which can reach up to 100% sea-ice concentration, in isolated patches.

With best regards,

Jan.

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Sea Ice Report #11.6/2016

by the Antarctic Gateway Partnership Sea Ice Service*

11/03/2016

- **Casey Station**
  A high-resolution visible image is shown in Figure 1. The voyage track of icebreaker *Shirase* (up until 11/03/2016 05:00 UT) is given by the orange line.

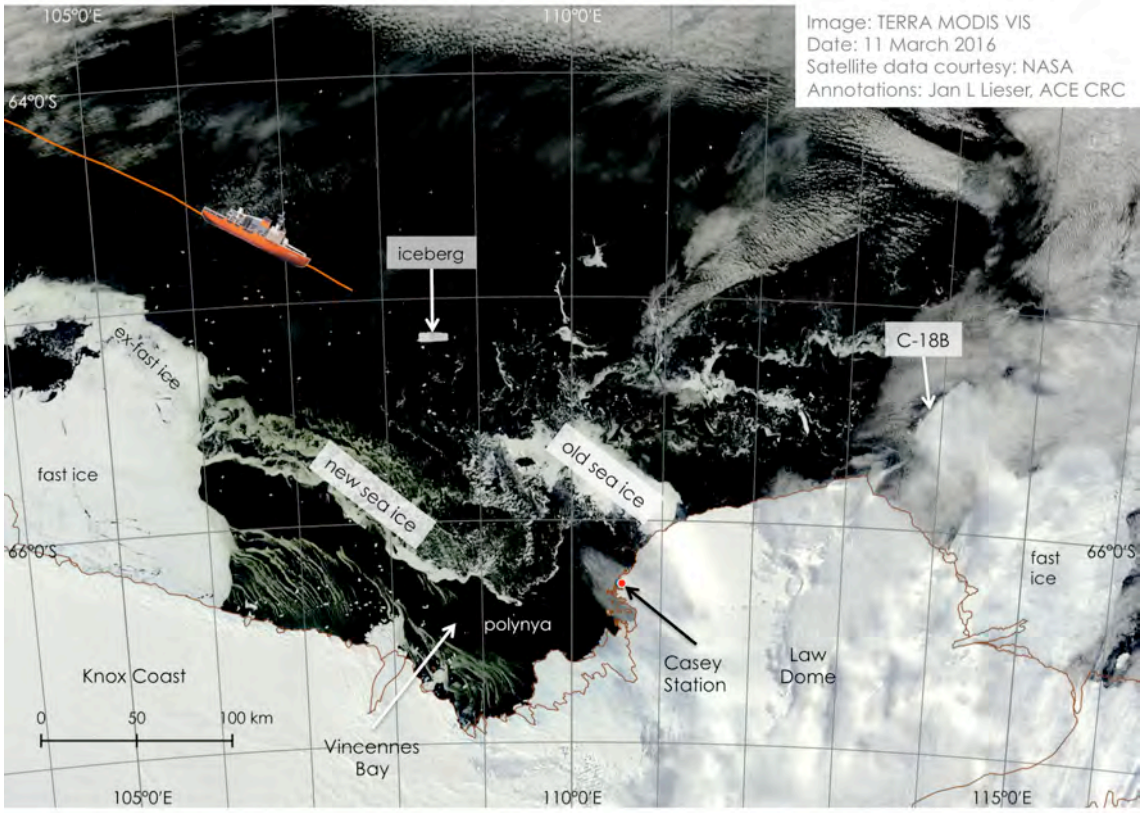

Figure 1: TERRA MODIS VIS, acquired 11/03/2016 and provided by NASA.

In Vincennes Bay, new sea-ice formation can be seen (with some greenish discolouration, suggesting biological activity in the proximity of the sea ice). North of Casey Station, some old, broken ex-fast ice remains local. Between the old and the new sea ice is a region of overall very low sea-ice concentration.

With best regards,

Jan.

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Sea Ice Report #12.1/2016

by the Antarctic Gateway Partnership Sea Ice Service*

17/03/2016

- **Antarctica**
  Figure 1 shows colour-coded sea-ice concentration anomaly, for February 2016. Anomalies provide a measure of the difference between a value (here: sea-ice concentration) at a given time (here: February 2016) and the long-term average. Anomalous negative concentration (less than average sea ice) is given in red as it typically indicates warmer than usual conditions. Conversely, positive anomalies (more than usual sea ice) are shown in blue.

  Additionally, the long-term median sea-ice extent for February is indicated by the black line, in Figure 1.

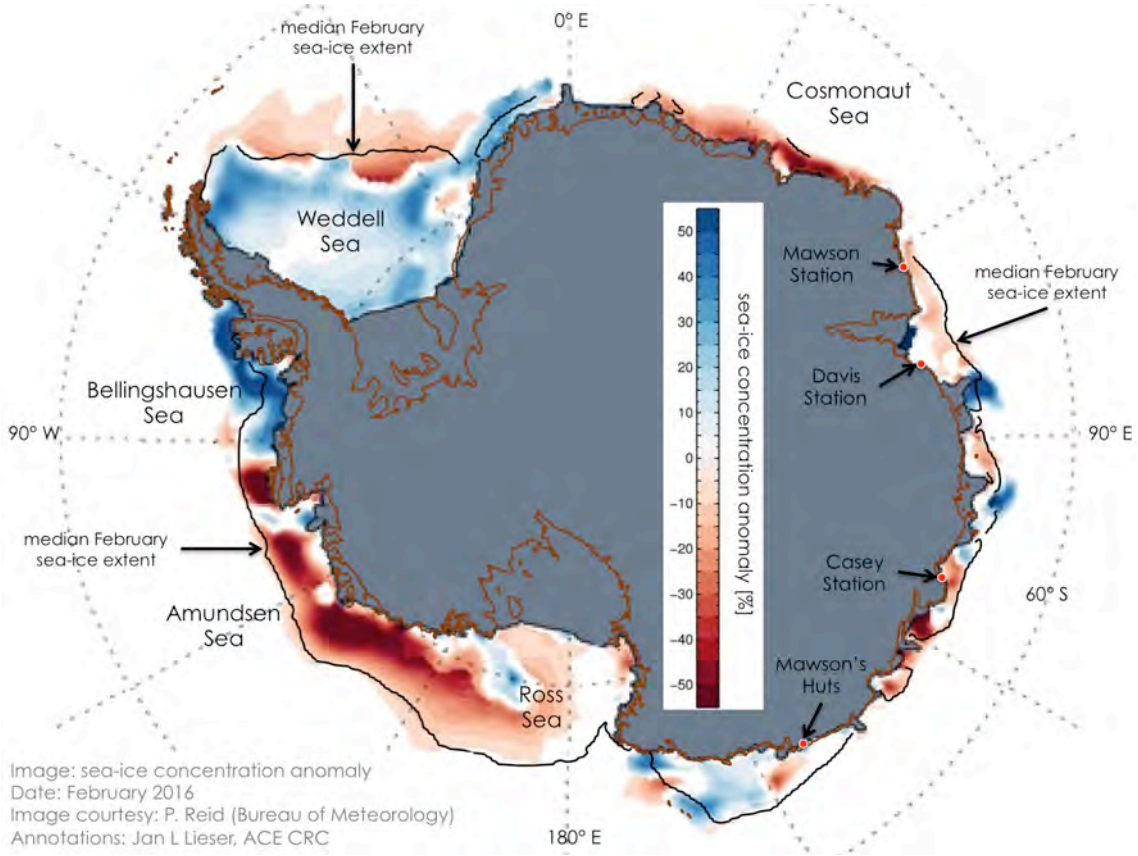

Figure 1: Sea-ice concentration anomaly, provided by P. Reid (Bureau of Meteorology).

The strongest (positive and negative) anomalies can be seen in the Bellingshausen and Amundsen seas. In the Cosmonaut Sea, a

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large-scale negative anomaly is observed, as well as east of Casey Station, off the Totten Glacier, which is only smaller in area. East of Davis Station, a strong positive sea-ice concentration anomaly is found, off the West Ice Shelf. Around the rest of Antarctica, mixed signals of moderate anomalies are found.

- **Mertz Glacier**
  Between 140° E and 148° E, strong polynya activity can be seen (Figure 2), which results in sea-ice production.

  We note the recent movement of a large iceberg (red outline in the figure, location on 02/02/2016) that was previously enclosed by fast ice, east of Mertz Glacier (see Sea Ice Report #09.1/2016). During the past three weeks, it has left its location and is now in front of Mertz Glacier and drifting northwestward.

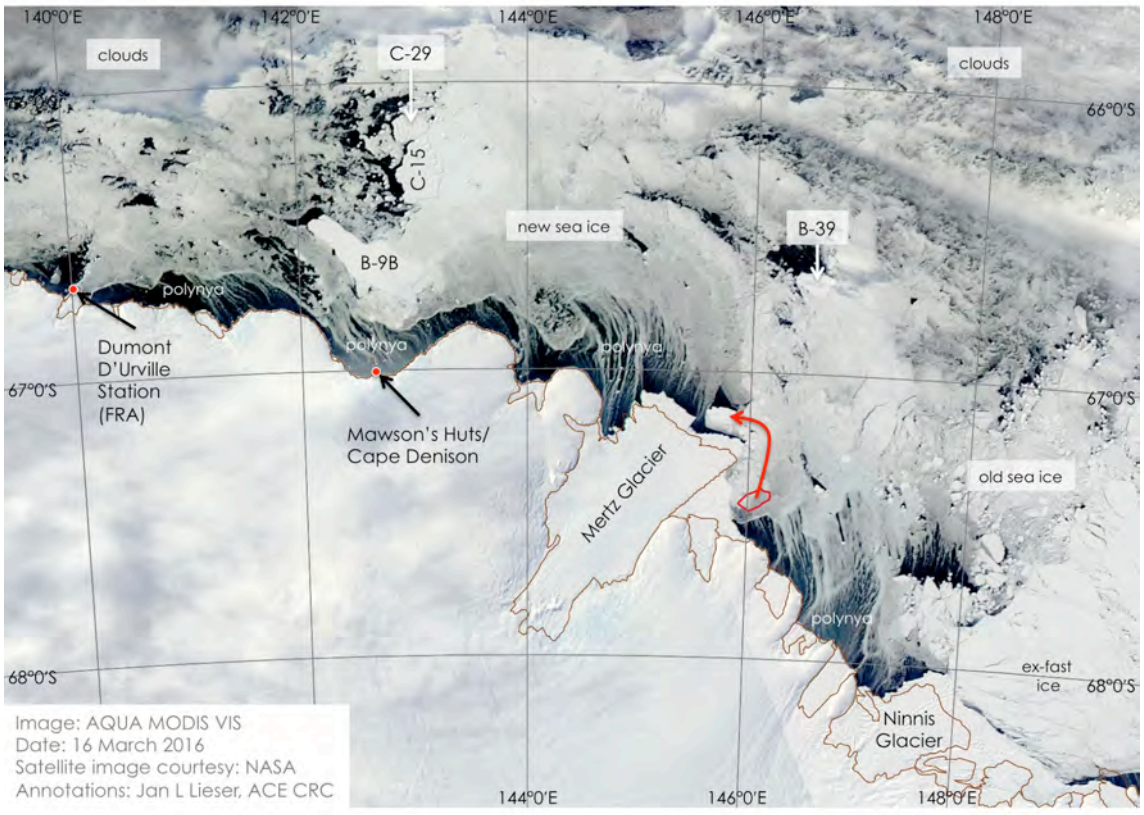

Figure 2: MODIS VIS scene, acquired 16/03/2016 and provided by NASA.

With best regards,

Jan.

Sea Ice Report #13.1/2016

by the Antarctic Gateway Partnership Sea Ice Service*

23/03/2016

- **Totten Glacier**
  Even though autumn conditions have set in and large-scale sea-ice formation can be seen around Antartica, we still notice continuing break-up of fast ice in some areas, for example off Law Dome (see Figure 1). Off Williamson Glacier and the Dalton Iceberg Tongue, red scribble lines indicate new fast ice edges. Southeast of iceberg C-18B, green scribble lines enclose an area (roughly 2200 km^2) that was covered by fast ice, only five days ago.

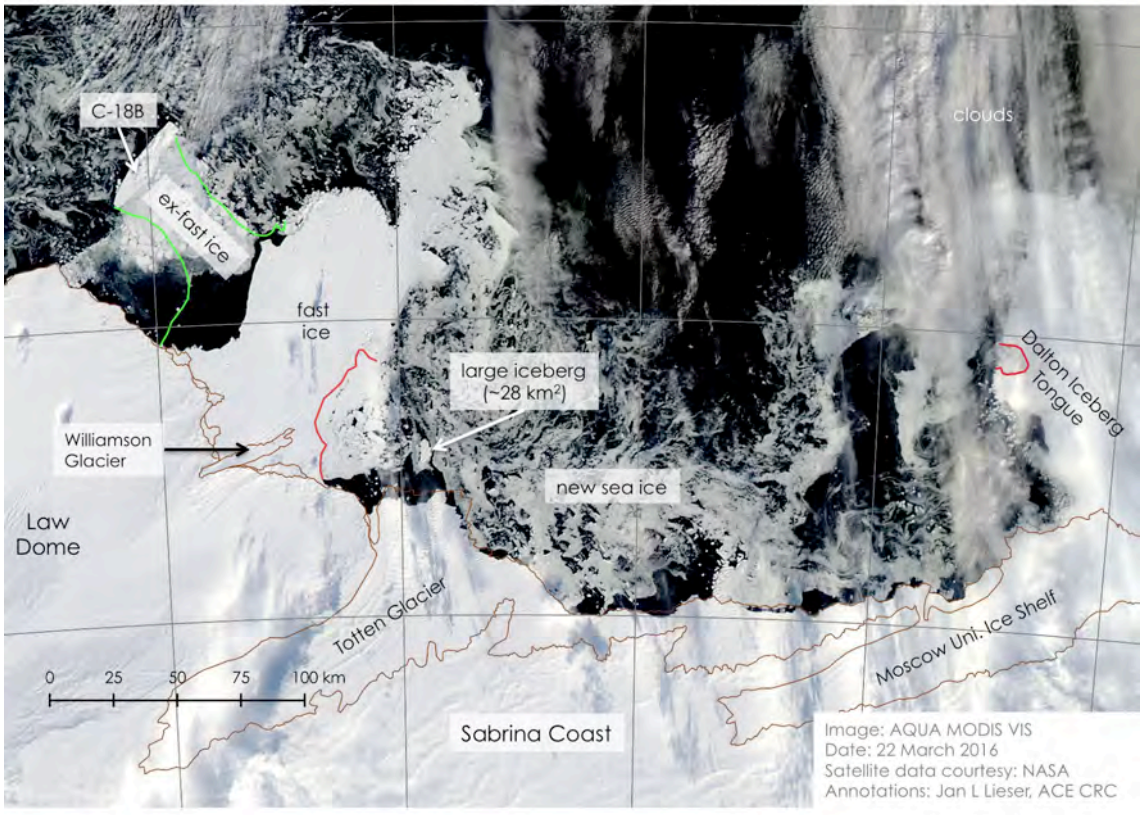

Figure 1: MODIS VIS scene, acquired 22/03/2016 and provided by NASA.

A combination of wind and waves/swell generated by the passage of a large, low-pressure system in the north might be responsible for this.

With best regards,

Jan.

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Sea Ice Report #14.1/2016

by the Antarctic Gateway Partnership Sea Ice Service*

31/03/2016

Throughout late summer, sea-ice extent around Antarctica was tracking slightly below average but well within the envelope of space-borne observations, starting in 1978. Since late March, the circum-Antarctic extent has moved to slightly above the long-term average.

Figure 1 shows daily sea-ice concentration (30/03/2016) for East Antarctica together with the median sea-ice extent for March and April (solid and dashed white scribble line, respectively).

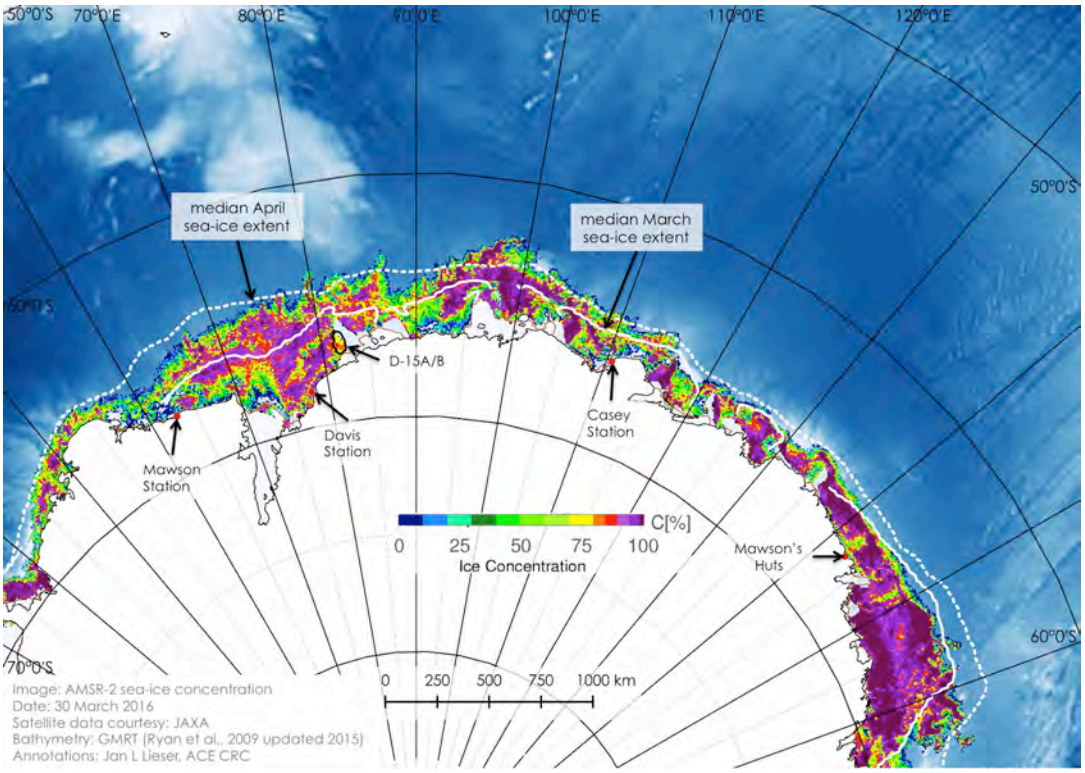

Figure 1: Sea-ice concentration, acquired 30/03/2016 and provided by PolarView.

Sea-ice concentration and extent show mixed signals in the region, at the end of March. East of Mawson's Huts, high concentration of sea ice is largely below (south of) the median March extent, while off Casey Station medium-high concentration of sea ice extends beyond (north of) the April median already.

With best regards,

Jan.

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Sea Ice Report #14.2/2016

by the Antarctic Gateway Partnership Sea Ice Service*

31/03/2016

- **Commonwealth Bay**
  An almost totally cloud-free scene of the sea-ice zone east and west of Mertz Glacier is shown in Figure 1. Various large, tabular icebergs are marked in the figure.

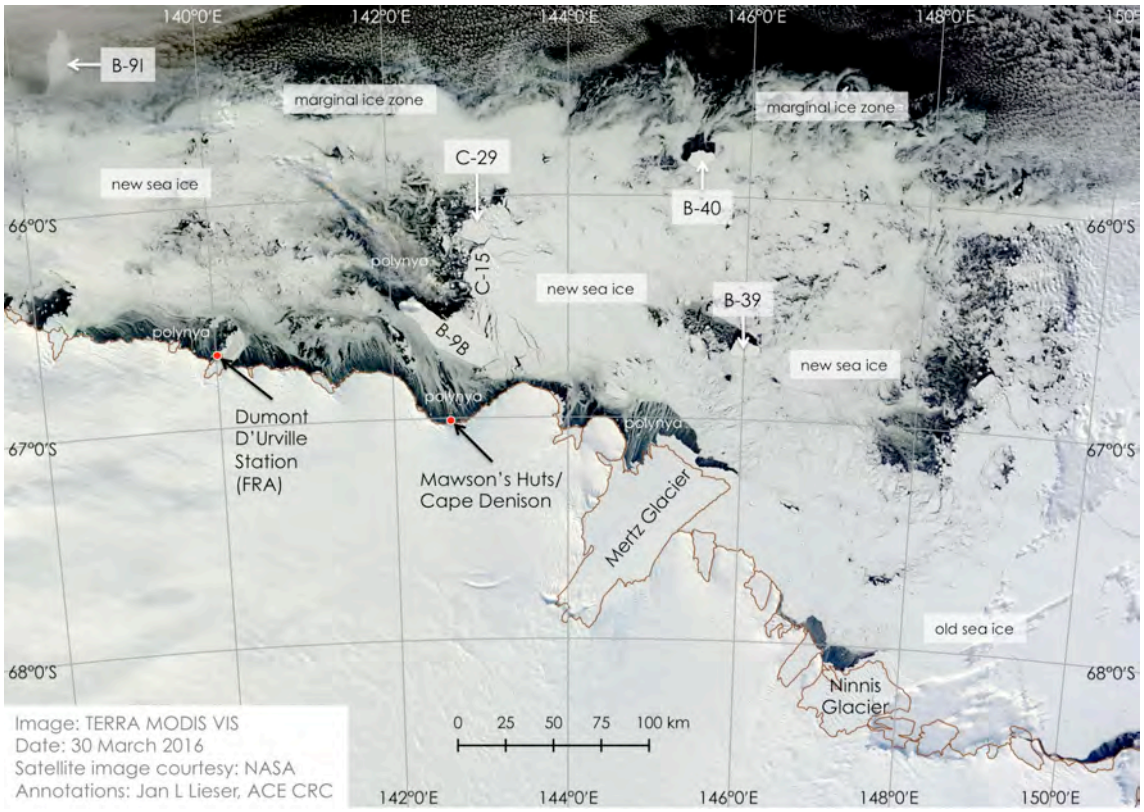

Figure 1: MODIS VIS scene, acquired 30/03/2016 and provided by NASA.

Sea-ice production is well underway in the polynyas of the region. The altered orientation of iceberg B-9B is clearly supporting the export of new sea ice, out of Commonwealth Bay, off Cape Denison.

Off Dumont D'Urville Station, some sea ice is consolidating behind a row of smaller icebergs, likely to form new fast ice towards the coast, east of the station.

With best regards,

Jan.

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About the authors:

Jan L Lieser

Dr. Jan Lieser is a meteorologist and marine glaciologist with the Antarctic Gateway Partnership, a special research initiative by the Australian Research Council. His research focus is airborne imaging techniques using digital aerial photography and scanning LiDAR to estimate sea-ice thickness. He has also researched on-site polar meteorological observations and sea ice geophysical properties, as well as numerical modelling of Arctic sea ice and Antarctic subglacial Lake Vostok, and the interpretation of remote sensing data. He was a wintering scientist at the German Neumayer Station and has participated in several field research programs in both Antarctica and the Arctic Ocean, conducted by the university's research partners, the Australian Antarctic Division, and the German Alfred Wegener Institute for Polar and Marine Research.

Robert A Massom

With more than 30 years experience in a broad spectrum of polar-related research, Dr Rob Massom has worked extensively both in Arctic (1980-1992) and Antarctic (1986-present) research. His current research interests include changes in Antarctic sea ice and polar oceans and their physical and ecological significance, and bipolar comparisons; the impact of modes of large-scale anomalous atmospheric circulation and extreme events on sea ice properties and ecology; remote sensing of sea ice and its validation; snow cover on sea ice (characteristics and impacts); sea ice as a habitat; and interactions between the Antarctic Ice Sheet and sea ice (including ice-shelf breakup processes). Rob has participated on three Arctic and ten Antarctic major international multi-disciplinary sea-ice research field studies.

Petra Heil

Dr Petra Heil works as a senior research scientist within the Climate Processes and Change Program of the Australian Antarctic Division, and the Cryosphere Program of the Antarctic Climate & Ecosystems CRC. Her research concerns physical sea-ice processes, which she investigates using *in-situ* or remotely sensed information and numerical modelling. Her current research interests include the investigation of sea-ice drift and deformation; sea-ice modelling (stand-alone and coupled codes, decadal modelling and short-term forecasting); fast-ice studies, including mixed-layer processes; spatio-temporal variability in Antarctic and Arctic sea ice, and their interaction with polar oceans and atmosphere; and polar atmospheric processes. She has participated on several Antarctic and Arctic major multi-disciplinary sea-ice and marine-science research field campaigns, and wintered at Davis Station working on a multi-disciplinary fast-ice study.

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